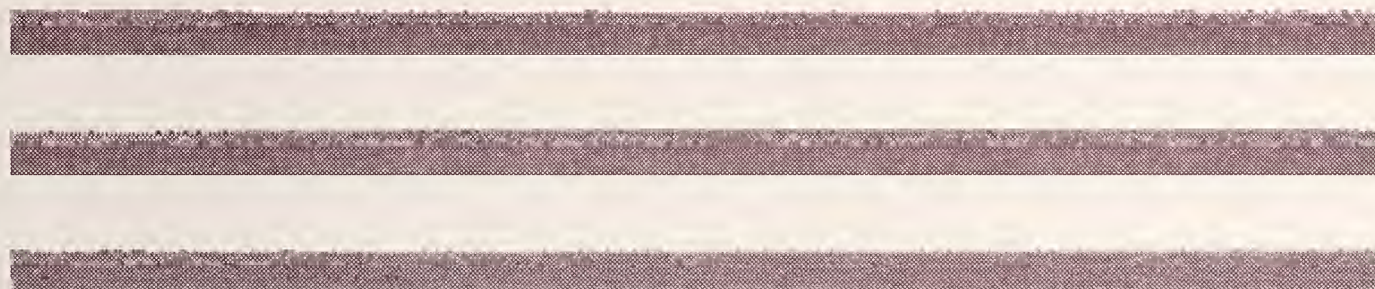


Agency for Health Care Policy and Research

Annotated Bibliography

Information Dissemination to Health Care Practitioners and Policymakers



U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
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Preface

As the volume of information resulting from clinical and health services research has grown, disseminating this information in ways that it can be used in policy- and decisionmaking has become an important public policy issue. This annotated bibliography, produced by the Agency for Health Care Policy and Research (AHCPR), is designed to facilitate access to conceptual work and empirical research on dissemination of clinical information and innovation to policymakers and health care practitioners. A separate annotated bibliography on effective dissemination of health care and related information

to consumers is planned as a companion document to this bibliography.

An important part of AHCPR's mission is to contribute to the decisionmaking process of policymakers, providers, and consumers of health care by publishing, and otherwise making available, the results of medical effectiveness research and other AHCPR-sponsored activities. We believe that this annotated bibliography will be useful to clinicians, health services researchers, and others interested in the conduct of research or research findings on effective dissemination.

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Introduction

This annotated bibliography presents selected conceptual and empirical work on effective dissemination of clinical and other health-related information to health care practitioners and policymakers. The term “effective dissemination” includes the concept of diffusion of knowledge and information as well as the acceptance, inculcation, and utilization of disseminated information. This definition is based upon a growing recognition that distribution of information alone is insufficient to ensure adoption or use.

The document is intended to assist both those conducting dissemination research and those interested in understanding the scope of dissemination literature. The literature ranges from the diffusion of technology and innovations, and knowledge and research utilization, to promising mechanisms for ensuring that health services research findings and clinical practice guidelines are incorporated into clinical practice and into decisionmaking processes of individuals and organizations.

We have restricted the references in this bibliography to health care practitioners and policymakers because that literature is more focused as it pertains to the dissemination of clinically oriented health information. Next year the Agency for Health Care Policy and Research (AHCPR) plans to issue a separate annotated bibliography on effective dissemination of health information to consumers, with references from social marketing, mass media and communications, and other fields.

Overview of the Dissemination Challenge

The concern with effective dissemination today grows from a lengthy history of the study of diffusion, a frustration with the high volume of new information flowing from scientific and biomedical research, and a frequently unacceptable lag time between publication of credible science and its adoption into practice. Early research of diffusion in health care evolved from the work of agricultural extension agents in disseminating information on innovations to farmers.

In the 1960's, the landmark *Diffusion of Innovations* by Everett Rogers established a framework for understanding the subject generally. *Medical Innovation* by James Coleman, Elihu Katz, and Herbert Menzel set the pace for examining the rate at which medical innovations diffused into American

society. The issue of how new medical technology—equipment, drugs, and procedures—was diffusing to the health care system, practitioners, and consumers became the subject of both debate and research. The debate largely focused on policy issues posed by the rapid spread of medical equipment and its implications for the cost of health care. Moreover, the effectiveness and benefits of some of the technology were not always evident. Research focused on how new technology and information was received, assimilated, and used, the characteristics of innovation adoption, channels of communication and what predisposed target audiences to change their behavior as a result of using information and new knowledge.

By the late 1970's and early 1980's, several trends were emerging that have contributed to today's dissemination challenge. First, in some cases, it was discovered that both negative and positive findings about the effectiveness of certain procedures and therapies were not being incorporated into clinical practice. Second, the sheer volume of biomedical and medical information began to make it increasingly difficult to keep track of publications and developments in medicine. Third, information-gathering routes became more complex and multifaceted, with the mass media a primary conduit of research findings providing a cue for the profession to seek out and read professional medical journals.

Furthermore, the number of randomized clinical trials and other studies has proliferated, raising concerns over whether and how this information “explosion” was reaching the awareness of clinicians or clinical practice sites. Even when research findings were available, uncertainty was engendered over the applicability of findings to individual patients and by the fact that studies sometimes contradicted one another. Finally, growing numbers of small area studies revealed wide disparities in the type and amounts of care provided to patients with similar health problems, which reflected lack of certainty regarding appropriate or effective treatment. The interest in development of clinical practice guidelines to reduce variations in health care delivery and improve its effectiveness has also evolved in part from these trends.

These trends have converged into the current dissemination challenge. Assessments of the degree to which information dissemination has resulted in changed behavior or improved health care suggest that we must do a better job of dissemination. Simply

making information or guidelines available is not sufficient to their proper consideration and use.

Dissemination and AHCPR

The authorizing legislation that established AHCPR (Public Law 101-239, the Omnibus Budget Reconciliation Act of 1989) focuses activities on enhancing the quality, appropriateness, and effectiveness of health care services and improving access to that care. AHCPR is the principal health services research component in the U.S. Department of Health and Human Services.

AHCPR conducts a broad range of health services research. AHCPR's Medical Treatment Effectiveness Program (MEDTEP) investigates the effects of variations in health care practices on patient outcomes and develops and disseminates scientific information to improve patient care. Under MEDTEP, outcomes research is conducted on a variety of clinical conditions through extramural research using both large, multiyear studies conducted by Patient Outcomes Research Teams (PORTs) and other research grants; clinical practice guidelines are developed by private sector panels for specific conditions; data are collected and organized to conduct outcomes research and develop clinical practice guidelines; and a broad multifaceted dissemination program has been established to ensure widespread distribution and use of AHCPR products.

AHCPR also conducts health care technology assessments and sponsors intramural and extramural research on issues of organization, financing, and delivery of services by the health care system.

Public Law 101-239 directs AHCPR to "publish, make available, and otherwise disseminate, in a form understandable and on as broad a base as practicable so as to maximize its use" the results of its research and other activities. The Center for Research Dissemination and Liaison within AHCPR is responsible for disseminating these products. The Center also makes available data and provides indexing, abstracting, translating, publishing, and other services leading to effective dissemination. In addition to these activities, the Center sponsors applied research and demonstrations in dissemination through the use of grants and contracts. The goal of AHCPR dissemination activities is to facilitate the effective dissemination of research findings, including clinical practice guidelines and other AHCPR products, using both precepts of good communications and the scientific evidence on dissemination and other techniques that foster assimilation and adoption or use of new information.

Content and Organization

Effective dissemination of clinical and health information draws on fields of communications and information theory, commercial marketing, social and behavioral psychology, education, computer sciences, and policy sciences.

This annotated bibliography contains selected literature from diffusion of innovations and disseminating information to health care practitioners and policymakers. For the most part, the references in this bibliography are from 1980 to the present. Some earlier books and journal articles have been included when they have made a substantial contribution to the field. The majority of the works cited are related to health and medicine, and include health services and medical research articles. Some conceptual or theoretical work is included when it directly relates to diffusion and dissemination. The references of this bibliography are organized into the following sections:

Innovation Diffusion and Adoption

Earlier work on innovation diffusion and adoption is included, especially seminal work that has contributed to our understanding of dissemination issues today, including the literature on technology diffusion. Some early books examining diffusion are included along with literature on applying innovation diffusion theory to health care, and some research on organizational innovation. A limited amount of conceptual or methodological references are included when they propose models that may contribute to a better understanding of dissemination, particularly where the health literature is sparse (for example, the role of organizational factors in diffusion and dissemination).

Dissemination and Knowledge/Research Utilization

Dissemination entails an element of intentionality that is more focused than the earlier and more passive concept of diffusion. A general body of literature has grown up around knowledge and research utilization, which are concerned about ways in which knowledge and research are applied and used. These areas have a slightly different focus than innovation diffusion, often examining the use of "knowledge" and "research" without reference to the discrete elements that are included in these terms.

Communications and Information Sources

This section contains health and clinical studies that pertain to communication patterns among health care

practitioners (as well as their information habits and sources) and to the growing difficulties of information management in health care. As the volume of research findings has burgeoned, there has been a concomitant increase in the study of where health care practitioners and others get their information and what communication patterns are important with respect to disseminated information.

Behavior Change Methods as Potential Dissemination Mechanisms

The references in this section pertain to methods that can facilitate behavior change among health care practitioners, including consensus methods (primarily evidence on the effect of the Consensus Development Program of the National Institutes of Health [NIH]), feedback, physician educational processes (including continuing medical education), academic detailing, educational techniques, the use of opinion leaders, and other methods. These mechanisms channel information to physicians; introduce innovations into the practice of medicine, nursing, or other health disciplines; or enable a change in practitioner behavior. As such, they offer promise as potential dissemination avenues. The references have been organized into the following subject areas.

- General references to practitioner behavior change
- Consensus development
- Continuing medical education
- Feedback
- Other methods, including academic detailing

Computerized Data Bases, Expert Systems, and Medical Informatics

Medical informatics is the umbrella term used to encompass the variety of techniques that harness computers to manage clinical and health information. These include automated reference systems, management and health information systems, and expert systems. The references in this section include conceptual and overview articles and specific descriptions of some of these systems as examples.

Background Articles and Miscellaneous References

This section contains other literature that contributes to a better understanding of the interrelationship between dissemination and several current issues: the need for effective clinical practice guidelines and their widespread dissemination, difficulties encountered in stimulating practice change through clinical practice guidelines, and references on clinical decisionmaking and information needs. References that do not fit in the other sections are also included.

There are some caveats about these categories. First, ambiguity among them is inevitable and there are overlaps between and among the categories. The articles on the NIH Consensus Development Program were included in the behavior change section because many of the references on this program have examined the degree to which the consensus statements resulted in changed clinician behavior. Second, there is not a separate section on opinion leaders because the work in which their importance is referenced principally falls in the other categories: "Innovation and Diffusion," "Communications and Knowledge/Research Utilization," and "Behavior Change Methods as Potential Dissemination Mechanisms." Third, international references are excluded except a small number of selected articles that provide evidence on dissemination in Canada.

Technical Note

References in this bibliography were obtained through an electronic search of the National Library of Medicine's MEDLINE and DIALOG and through a review of references of many of the articles included in the document. In addition, the computerized reference lists of the Human Interaction Research Institute in Los Angeles, California, and the Research & Development Resource Base in Continuing Medical Education at McMaster University in Hamilton, Ontario, were consulted. Finally, a literature review on dissemination by the Area Health Education Center in Arkansas and the Western New York Geriatric Education Center provided additional references.

Innovation Diffusion and Adoption

- 1 **Backer, T.E. (1987, January). Research Utilization and Managing Innovation in Rehabilitation Organizations. *Journal of Rehabilitation* 54(2), pp. 18–22.**

The management of innovation in today's rehabilitation organizations centers on creating highly cost-effective programs, while engaging in effective cutback management strategies that preserve the core of needed services to be utilized effectively in service settings. Both researchers and administrators must meet several challenges for research to be utilized effectively in service settings including: (1) awareness of the innovative program or practice; (2) change, and change is hard; (3) resources; and (4) belief that the innovation will work in their organization. Six strategies (from 30 years of research on the utilization process) focus on psychological and structural aspects of the change process that can be used to promote the utilization of research or innovations including: (1) interpersonal contact; (2) planning and conceptual foresight; (3) outside consultation on the change process; (4) user-oriented transformation of information; (5) individual and organizational championship; and (6) potential user involvement. The author discusses these challenges and strategies and offers suggestions for both researchers and rehabilitation administrators.

- 2 **Backer, T.E., R.P. Liberman, and T.G. Kuehnelt. (1986). Dissemination and Adoption of Innovative Psychosocial Interventions. *Journal of Consulting and Clinical Psychology* 54(1), pp. 111–118.**

This article highlights the challenges facing researchers, developers of innovative programs, and practitioners as they promote the spread of new clinical (psychosocial) interventions. Three examples of successful utilization are described—the Behavior Analysis and Modification Project, the Teaching Family Model for group home treatment of deviant adolescents, and the Fairweather Hospital-Community Treatment

Program (Lodge Program). The authors studied the Behavior Analysis and Modification Project by disseminating information (6 program modules) and skills to a sample of 40 community mental health centers (CMHCs) across the Nation. The data reflect findings from 18 CMHCs (total 562 staff members) from which 26 percent completed the full program containing a 2-day workshop and 6 structured in-service training sessions over 3 months. Six factors that appeared to promote utilization in these three models were (1) interpersonal contact between potential adopters and those knowledgeable about innovations, (2) outside consultation on the adoption process, (3) organizational support for innovation, (4) persistent championship by agency staff, (5) adaptability of the innovation, and (6) availability of credible evidence of success. These factors are consistent with findings from the larger literature on utilization, and most are also relevant to adoption of innovations by individual psychotherapists.

- 3 **Backer, T.E. and K.B. O'Hara. (1989, December). Knowledge Transfer and Utilization in Health Care: A Review for the National Emergency Medical Services for Children Program. Los Angeles, CA: Human Interaction Research Institute, pp. 1–32.**

This report summarizes the knowledge base on utilization in the health care arena, examines basic principles for effective utilization (which seem to hold regardless of the subject area), and analyzes these principles in terms of utilization activities now being developed by the National Emergency Medical Services for Children Demonstration Program (EMSC) demonstration projects. An extensive review of the literature is included on types of medical technologies, levels of innovation utilization, challenges and basic strategies in utilization, health care cost containment, and utilization strategies used by the EMSC Demonstration Program.

- 4 Battista, R.N. (1989). Innovation and Diffusion of Health-Related Technologies: A Conceptual Framework. *International Journal of Technology Assessment in Health Care* 5, pp. 227–248.

The development and diffusion of health-related technologies constitute an extremely complex process. The rational development, adoption, and use of the technologies (equipment, drugs, and procedures) presupposes generation of valid information on the technologies and its appropriate dissemination. The author examines the phenomenon of technological innovation and diffusion, reviewing what is known about the factors determining the diffusion of high, medium, and low technologies, and suggests strategies for controlling the diffusion of these technologies. A research program is proposed to improve understanding of the process of development and diffusion of health-related technologies.

- 5 Becker, M.H. (1970, February). Factors Affecting Diffusion of Innovations Among Health Professionals. *American Journal of Public Health* 60(2), pp. 294–304.

The author examines the diffusion of public health programs among health departments and identifies factors facilitating or inhibiting adoption of new programs by administrators of local health departments. Data gathered from 95 local health officers from three States (Michigan, Illinois, and New York) involved two kinds of innovations: measles immunizations (high adoptive potential, HAP) and diabetes screening (low adoptive potential, LAP), as well as information on communication networks. The results reveal that the speed with which public health innovations are adopted by health officers depends on their location in the communications network of their groups, although the correlation is somewhat reduced for diabetes screening. Other influences on the speed of adoption include the degree to which the individual looks beyond the local situation for guidance and satisfaction, reliance on

outside sources of scientific information, and certain background factors in training. The study results are consistent with the “two-step flow” communication concept that new ideas are first tried by those predisposed to external information and then passed on to peers. The findings provide a basis for recommendations to reduce the delay in accepting innovations.

- 6 Becker, M.H. (1970). Sociometric Location and Innovativeness: Reformulation and Extension of the Diffusion Model. *American Sociological Review* 35(2), pp. 267–283.

This seminal study traced diffusion paths of two innovations (with different degrees of “adoptive potential”) among directors of local health departments in Michigan, Illinois, and New York. A total of 93 health officers responded to a self-administered questionnaire and a followup telephone interview concerning the dependent variables of time of adoption, relative centrality, and most-valued source of information and other dimensions relevant to background, training, and attitudes. Substantial correlations were obtained between the time an individual adopted an innovation and both his/her relative position in sociometric networks (“centrality”) and most valued source of information. Earliest adopters of easily accepted programs were opinion leaders, while pioneers in the low adoptive potential innovation were marginal to their groups. The concept of “system delay” is introduced wherein the stable influence-adoption configuration delays accepting risky innovations by pioneers until others have demonstrated its feasibility through prior adoption. Finally, a modified model for diffusion among professionals is presented, suggesting that the professional’s innovativeness determines centrality in the communication network rather than *vice versa*, which had been the theoretical assumption. Further, it appeared that a desire to maintain or increase prestige (tempered by the risks of adoption) motivates the professional to seek sources likely to provide information on innovations.

- 7 Bingham, R.D., P.K. Freeman, and C.L. Felbinger. (1984, March). *Innovation Adoption in an Urban Setting: An Application of Downs and Mohr's Methodological Prescriptions. Knowledge: Creation, Diffusion, Utilization* 5(3), pp. 309–338.

The authors tested the Downs and Mohr thesis pertaining to the adoption of innovations, and seven methodological “prescriptions” that Downs and Mohr suggest would help advance innovative research. Data were collected from 3 sources including a study regarding adoption of a set of 7 innovations from 231 American cities (a total of 1,212 innovation-decision cases). The data tend to support the distinction that Downs and Mohr made regarding the primary attributes of both innovations and organizations by showing that the different variables relate in different ways depending on the primary characteristics of either the innovations or the organizations. Similarly, different variables explained innovative behavior in mayor-council cities than those in council-manager cities. The findings do not substantiate the concepts of a single theory of innovation or show any evidence to suggest that Downs and Mohr are incorrect in their assessment of the significance of primary attributes. The results do not settle the debate as to the criticisms of Downs and Mohr but tend to support the use of interactive, nonlinear models.

- 8 Coleman, J.S., E. Katz, and H. Menzel. (1966). *Medical Innovation: A Diffusion Study*. Indianapolis, IN: The Bobbs-Merrill Company.

This book is a landmark study of medical innovation and offers an elucidation of the social processes operative in all innovation. The authors use a case study approach involving examination of four different medical communities to track the introduction of a new drug (Gammanym) and its acceptance through time among prescribing physicians. The findings are based on a framework of quantitative data of actual prescriptions as well as sociometric measures to determine the effective social networks and professional patterns of advice, consultation, and discussion. The data are used to document

the stages of adoption, to describe the characteristics of both early and late adopters, and to identify determinants of adoption. Major findings include: (1) a social intermediary (colleague) rather than impersonal media (journal) was most frequently the influencing factor in the physician's prescribing of a new drug; (2) the greater the involvement of the physician in the medical community, the greater likelihood of early drug adoption; and (3) demonstration of two distinct mathematical models of adoption characteristics that indicate the importance of social ties as channels through which an innovation moves.

- 9 Damanpour, F. (1988, October). *Innovation Type, Radicalness, and the Adoption Process. Communication Research* 15(5), pp. 545–567.

This article reviews studies about the impact of organizational factors on the adoption of innovations, integrating empirical findings along three dimensions: (1) innovation type (administrative versus technical); (2) innovation radicalness (incremental versus radical); and (3) stages of adoption (initiation versus implementation). A conceptual framework is proposed for multidimensional studies of innovation in organizations as a basis for more comparable research for developing theories of organizational innovation. Contrary to previous assertions that results of innovation research are inconsistent, this study suggests that, when categories within each dimension are distinguished, there is agreement among research results. The development of realistic theories of innovation adoption in organizations is possible if future innovation studies (1) systematically differentiate among dimensions, (2) recognize differences between types of organizations with emphasis on the organizational consequences of adoption of innovations (requiring the study of a large number of different innovations and degrees of radicalness over time), and (3) consider the adoption of innovations within the framework of organizational effectiveness or performance. The author suggests innovation studies that consider more than one dimension and examine various contingencies of the interaction between the dimensions.

- 10 Feeny, D. (1985). Neglected Issues in the Diffusion of Health Care Technologies: The Role of Skills and Learning. *International Journal of Technology Assessment in Health Care* 1, pp. 681-692.

This paper reviews the current literature on the process of diffusion to clarify what is known, and it delineates important areas for additional research. Until information is available on case studies involving disembodied technical change, and until the quantitative importance of skills, learning, and experience has been assessed, there will not be an adequate model of health care technology diffusion. A variety of factors affect the adoption and utilization of new technologies, including severity and urgency of the health care problem, availability of alternatives, financial and other advantages, compatibility with the current style of practice, prestige of the advocates for the new technology, channels of communication, patient preferences, physician attitudes, regulation, and climate of litigation. The literature does not allow for a precise accounting of the contributory role of each factor. Moreover, there is a lack of research on the determinants of utilization, as opposed to adoption, of technologies.

- 11 Fennell, M.L. and R.B. Warnecke. (1988). *The Diffusion of Medical Innovations*. New York: Plenum Press.

This book explores the emergence and development of the organizational network and its role in the diffusion of modern medical technology by analyzing data from a case study of seven regional networks. All of the networks were established to promote the diffusion of "state-of-the-art" treatment for head and neck cancer to community practitioners in seven different regions of the United States. How these networks achieved their specific character and functioned for a period of 3-4 years is presented using a comparative and descriptive study approach. The diffusion process is examined by looking at the development, structure, process, and performance of each network. Contingency theory from the resource dependence perspective on organizations is used to

determine how each organizational network adapted a single innovation to address particular problems in their own regions. Findings show that the classic innovation diffusion theory that describes the innovative physician as lone scientist and as solo practitioner is inadequate for understanding innovation in the modern medical setting.

- 12 Gordon, G. and G.L. Fisher (Eds.). (1975). *The Diffusion of Medical Technology*. Cambridge, MA: Ballinger.

This book contains eight monographs resulting from a 1972 Conference on the Diffusion of Medical Innovation sponsored by the National Institutes of Health and Cornell University. Each monograph draws from the conference participants' discussions and existing pertinent research to address the general issues and problems of diffusing medical technology, mapping out a broad perspective for understanding the problem-solving process involved. Organizational considerations and policy implications underlying the Federal interest in diffusion research are explored in terms of the public, the health system, and government intervention or lack of intervention. Various theoretical and methodological issues are raised in "trying to account for the disjointed nature of the data base and the apparent lack of an integrative framework," including a discussion of how the attributes of medical innovations may affect diffusion, particularly in terms of balancing cost against benefits as well as policy implications. An assessment of diffusion research is considered in three general areas: (1) intraorganizational, (2) interorganizational, and (3) research on predicting diffusion rates in different types of organizations. Intervention strategies that might optimize the diffusion process are offered along with suggestions for applying research findings to effect desirable modifications in the diffusion process.

Note: One chapter of the book is abstracted in this bibliography: Chapter 4, "Diffusion Research Methodology: Focus on Health Care Organizations" by Christian P. Tanon and Everett M. Rogers.

- 13 Greer, A.L. (1985). Adoption of Medical Technology: The Hospital's Three Decision Systems. *The International Journal of Technology Assessment in Health Care* 1(3), pp. 669–680.

The analysis is based on case studies of 25 hospitals' decisions concerning 12 potential technology adoptions, judged by a panel of physicians to be a fair representation of new treatment and diagnostic modalities available to community hospitals. The study focused on decisionmakers, their values and purposes, what resources they deployed toward realizing their values, and with what outcomes. The data consisted of 378 interviews of physicians, administrators, board members, and nurses asked to describe an innovation's career within the hospital including their initial awareness of the innovation, its sponsors and opponents, and its progress over time. Three "decision systems" for technology adoption emerged from the interviews including (1) the medical-individualistic decision system—dominant in evaluations of new clinical tools; (2) the fiscal-managerial decision system—applicable to replacement and accretion of technologies used in hospital departments; and (3) the strategic-institutional system—dominant in evaluating innovation proposals that imply substantial changes in the nature or future of a hospital. Community hospitals displayed adoption dynamics (rapid, widespread diffusion) differing markedly from those of teaching centers. The author discusses the relationship and conflict between the three decision systems, the limits of fiscal policy in producing change, and the need for knowledge of the relationship between the interventions and the behaviors producing the results.

- 14 Greer, A.L. (1977, Fall). Advances in the Study of Diffusion of Innovation in Health Care Organizations. *Milbank Memorial Fund Quarterly—Health and Society*, pp. 505–532.

This review article surveys research in diffusion of innovation as it applies to health organizations. The literature reveals one well-developed theory, the classical diffusion theory, that has proven useful in exploring individual responses to innovation and the

circulation among professionals of information relevant to innovations. Two other frameworks include organizational theory, which is concerned with what aspects of organizations constrain or facilitate the adoption or implementation of innovations, and political theory, which is concerned with what interests and values relevant to innovation are effectively represented in organizations, how they are expressed, and what is the outcome. Organizational theory has produced many variables for studying innovations; among these, funds and staff are associated with adoption. Methodological problems have made the assessment of structural factors difficult; political theory has contributed little to innovation theory. Weaknesses in available theory include the lack of emphasis on theory itself and the need for more studies to address certain attributes of innovations and medical technologies. Furthermore, the application of classical diffusion theory is limited because of its traditional assumption that innovation is beneficial, although scholars and policymakers are now questioning the validity of this assumption.

- 15 Greer, A.L. (1984). Medical Technology and Professional Dominance Theory. *Social Science and Medicine* 18(10), pp. 809–817.

This article examines the theoretical and empirical bases for hypotheses of professional dominance and their utility in explaining hospital decisions to adopt new medical technologies. It also discusses activities and interrelationships of physicians and other decisionmakers to the acquisition by hospitals of technologies used by physicians. Data collected over 5 years from 25 voluntary community hospitals are based on 378 focused interviews with physicians, hospital administrators, nurses, and technicians, members of boards of trustees, and health planners and regulators on activities and observations relevant to assessment and acquisition of 12 medical technologies. The findings identify four categories of physicians: community generalists, community specialists, referral specialists, and hospital-based specialists. Members of the categories exhibit differences in skills and interests, relationships to hospitals and hospital technologies, and

access to the resources of organization influence. Three innovation decision systems are described—the medical-individualistic, the fiscal-managerial, and the strategic-institutional. Influential physicians associated with professional dominance are centrally involved in only the first of the three systems; the latter two are more associated with technology acquisition. The analysis does not support professional dominance as the principal dynamic propelling the expansion of medical technology and reveals that differentiated physician roles in the decision systems express the technological specialization of the medical profession that is separate from the management of hospitals.

- 16 Greer, A.L. (1988). The State of the Art Versus the State of the Science: The Diffusion of New Medical Technologies into Practice. *International Journal of Technology Assessment in Health Care* 4, pp. 5–26.

A theory is offered to explain the diffusion of new medical technologies into local community hospitals, emphasizing the “normal” processes by which information is received, circulated, and assessed by practicing physicians. The analysis is based on personal interviews with a non-statistical sample of physicians from hospitals including 205 physicians in the United States, 75 in the United Kingdom, and 10 in Canada. The study focused on the sources of information regarding (a) new technology that had attracted the physician’s attention and (b) a checklist of 12 technologies. Physician descriptions of their use of different types of assessment information provide insight into how local consensus on appropriate practice forms (to reduce medical uncertainty), guides behavior, and changes. The author offers an explanation of how dynamic technologies diffuse by differentiating “formed” (complete) and “dynamic” (still developing) technologies and the extent to which medical practice is locally organized. It is suggested that dynamic medical technologies arrive in local medical communities through individual local innovators, are promoted by idea champions, and as the characteristics of the technologies and their results become observable, are assessed by local opinion leaders. Within this

framework, previously puzzling findings regarding local practice variation and the poor relationship between practice behavior and the published literature become understandable.

- 17 Kaluzny, A.D. (1974, Summer). Innovation in Health Services: Theoretical Framework and Review of Research. *Health Services Research*, pp. 101–120.

The arrangements comprising the health care delivery system are analyzed in terms of social organization, and selected characteristics of the system are discussed that are pertinent to the study of diffusion and adoption of various types of innovations. Research currently under way or completed is then reviewed in terms of its contribution to overall understanding of the phenomenon of innovation, on both the individual practitioner and the organizational levels. Empirical research (available at the time this article was written) on health care innovations is reviewed using the framework in Rogers’ and Shoemakers’ “Communication of Innovation: A Cross-Cultural Approach” (1971). Literature on physician innovation is also summarized. The analysis is then used to delineate problem areas needing further study. The article provides a useful context in which to consider substantive findings of future empirical research.

- 18 McKinney, M.M., A.D. Kaluzny, and H.S. Zuckerman. (1991, Winter). Paths and Pacemakers: Innovation Diffusion Networks in Multihospital Systems and Alliances. *Health Care Management Review* 16(1), pp. 17–23.

This article examines the role of multihospital systems and alliances as “innovation carriers” and their relationships between diffusion strategies and innovation diffusion outcomes, offering a “supply-side view” of the innovation process. Drawing upon studies of interpersonal and interorganizational communications networks, the authors suggest how membership in a system or alliance, as well as network characteristics such as size, ownership type, and geographic dispersion, affects managerial innovation practices in hospitals. By acting as “sellers” of innovation and/or establishing linkages between affiliated

hospitals, systems and alliances influence innovation awareness as well as the range of innovation choices of their members. A review of the literature suggests that membership in multihospital systems and alliances is associated with more frequent use of "intra-system" sources of managerial innovation information than "extra-system" sources. Furthermore, greater use and earlier implementation of managerial innovations in multihospital systems and alliances is associated with membership in (1) larger systems, (2) church-related and investor-owned systems, (3) less geographically dispersed systems, (4) systems with more "integration-enhancing mechanisms," and (5) more mature systems. The authors conclude that the question of how network characteristics interact with organizational and innovation attributes to affect diffusion outcomes can be dealt with once the relationships between system characteristics and innovation practices are understood.

- 19 Meyer, A.D. and J.B. Goes. (1988, December). Organizational Assimilation of Innovations: A Multilevel Contextual Analysis. *Academy of Management Journal* 31(4), pp. 897–923.

This study examined the assimilation of innovations into organizations, a process unfolding in a series of decisions to evaluate, adopt, and implement new technologies. Assimilation was conceptualized as a 9-step process and measured by tracking 300 potential adoptions through organizations during a 6-year period. Process data were obtained by investigating the extent to which 25 hospitals assimilated 12 medical innovations. The authors advance a model suggesting that organizational assimilation of technological innovations is determined by three classes of antecedents: (1) contextual attributes, (2) innovation attributes, and (3) attributes arising from the interaction of contexts and innovations. As the dependent variable in this study, assimilation is conceptualized as a nine-step process. Two principal conclusions are drawn from the results: (1) since 59 percent of the variance in evaluation, adoption, and implementation was explained by the model, it affords reasonably good prediction of the extent to which a given

hospital will assimilate a given innovation, and (2) an organization's assimilation of a new technology is highly dependent upon attributes of the particular innovation in which it is embodied and upon attributes of the particular decision process in which it is aired.

- 20 Pelz, D.C. (1985, March). Innovation Complexity and the Sequence of Innovating Stages. *Knowledge: Creation, Diffusion, Utilization* 6(3), pp. 261–291.

This study merges two themes in the literature on diffusion of innovations—properties of the innovation itself (such as its complexity) and the time sequence of adoption stages. The case histories of innovation adoption from 18 local governments in small- to medium-size cities and counties (25,000–40,000 in population) were acquired from interviews on the history of events in adopting one of three kinds of technically based innovations (noise-control ordinance, energy conservation program, or solid waste management system). A total of 2,000 "episodes" (brief segments of interviews) were coded on a framework of seven innovating "functions" from concern (identification of need) to implementation and diffusion, and were coded on a time scale. A statistical method was applied to measure the time sequence of functions at each site and their separation from other functions; the resultant data were used to test the hypothesis that stages are more overlapping and the innovating process more "disorderly" for complex innovations. The hypothesis was supported for a measure of technical complexity but not for one of organizational complexity; the innovating process was found to be most orderly when a technically simple innovation was neither "custom-made" nor copied "ready-made," but was modified or adapted.

- 21 Rice, R.E. and E.M. Rogers. (1980, June). Reinvention in the Innovation Process. *Knowledge: Creation, Diffusion, Utilization* 1(4), pp. 499–514.

The authors discuss reinvention in the innovation process and argue for its inclusion in research on the diffusion of innovations, suggesting possible typologies and implications of reinvention. Reinvention is the

degree to which an innovation is changed by the adopter in the process of adoption and implementation after its original development, and it may involve both the innovation as a tool and in its use. The authors five-stage innovation model included agenda-setting, matching, redefining, structuring, and interconnecting; this differs from prior models in recognizing the innovation process as a matching of the adopter's perceived problem with the technological innovation, thus identifying the possibility of reinvention. Details are evaluated of an investigation of reinvention for Dial-A-Ride (DAR), a mass transportation innovation, where the uses of an innovation as well as the decision to adopt were studied. The authors suggest the need for recasting previous results in the light of the variable nature of each innovation adoption, and for the inclusion of the variable of reinvention in future diffusion research. Such a variable emphasizes the role of innovation adopters as active participants in the diffusion process, and it highlights the importance of the need to give local meaning to new information.

- 22 Roberts, E.B., R.I. Levy, S.N. Finkelstein, and others. (Eds.). (1981). *Biomedical Innovation*. Cambridge, MA: The MIT Press.

This is a set of monographs emanating from a 1980 Conference on the Development and Dissemination of Biomedical Innovation sponsored by the Office for Medical Applications of Research and the National Heart, Lung, and Blood Institute of the National Institutes of Health. Drawing from nonbiomedical and biomedical fields, a conceptual model of innovation is proposed as a four-stage process encompassing (1) the generation of ideas in basic, clinical, and applied research, (2) the communication of ideas, (3) the development of clinical applications, and (4) a product that goes from the research community toward diffusion and adoption in society. Theoretical models such as the "classical diffusion model" and the convergence model are presented. Research evidence and issues in the generation of biomedical innovations and the dissemination of medical technology including the efficacy

and impact of technology assessment are presented and discussed. Issues arising from biomedical innovation and their implications for managing biomedical innovation and for public policy conclude the book.

Note: Two chapters of this book are abstracted in this bibliography: Chapter 10, "Interpersonal and Unplanned Communications: Indispensable or Obsolete?" by Herbert Menzel, and Chapter 12, "Communications Linking Clinical Research and Clinical Practice," by Donald A. Young.

- 23 Rogers, E.M. (1983). *Diffusion of Innovations* (3rd Ed.). New York: The Free Press.

This seminal work synthesizes 3,100 publications on diffusion research. The main elements of the "classical diffusion model" are an innovation (idea, practice, or object perceived as new) communicated through certain channels, over time, and among members of a social system. The characteristics of an innovation as perceived by members of a social system determine its adoption. Five attributes of innovations are relative advantage, compatibility, complexity, trialability (the degree to which an innovation may be experimented with on a limited basis), and observability. The model takes into account the context of diffusion, dealing with where innovations come from and how their origins affect their diffusion. The differences between the innovation process in organizations and with the individual, where decisions differ in important ways, are discussed. The author presents limitations of the linear model of communication, upon which past diffusion research is based, and proposes a convergence model for certain types of diffusion. This convergence model defines communication as a process in which participants create and share information with one another to reach mutual understanding. New innovations generate uncertainty for individuals and organizations, and this provides the motivation to seek information. Thus the diffusion of innovations is a social process in which subjectively perceived information about a new phenomenon is communicated.

- 24 Rogers, E.M. and C.P. Tanon (1975). **Diffusion Research Methodology: Focus on health care organizations.** In Gordon, G. and G.L. Fisher (Eds.). *The Diffusion of Medical Technology*, chapter 4, pp. 51–77. Cambridge, MA: Ballinger.

The authors discuss effective research strategies to examine factors affecting medical diffusion. Their discussion includes (1) a review of knowledge of diffusion and its relevance to health system diffusion, using the “classical diffusion model” as a guide, (2) an assessment of the methodologies available for research, emphasizing the appropriate research design, (3) a description of what is known about diffusion of medical technology, including the specification of research questions that should have the highest priority, and (4) consideration of what type of administrative setting would facilitate the successful completion of the research. The authors conclude by stressing the importance of key decisions regarding research funding and coordination. They state that whether such decisions are made according to conventional wisdom or in light of scientific findings will influence the degree of success of diffusion in the next decade.

- 25 Sloan, F.A., F. Valvona, J.M. Perrin, and K.W. Adamache. (1986). **Diffusion of Surgical Technology: An Exploratory Study.** *Journal of Health Economics* 5, pp. 31–61.

The study presents an empirical analysis of the diffusion patterns of five surgical procedures (hip arthroplasty, coronary bypass surgery, morbid obesity surgery, retina repair, and cataract surgery). The study examines roles of payer mix, regulatory policies, physician distribution, competition among hospitals, and various hospital characteristics such as size and the spread of technologies. The principal data base is a time series cross-section of 521 hospitals based on discharge abstracts sent to the Commission on Professional and Hospital Activities. Overall, the results are consistent with a framework used to study innovations in other contexts in which the decisions of whether to innovate and timing depend on anticipated streams of

returns and cost. Innovation tends to occur in markets in which the more generous payers predominate, but the marginal effects of payer mix are small compared with effects of location and hospital characteristics, such as size and teaching status. Hospital rate-setting sometimes retarded diffusion while certificate-of-need programs did not. The authors note that their “evidence is more consistent with a framework that has been applied by economists to study diffusion than with the view that third-party payment, hospitals and their surgical staff decide about innovations without regard to market influences.”

- 26 Van De Ven, A.H. and E.M. Rogers. (1988, October). **Innovations and Organizations: Critical Perspectives.** *Communication Research* 15(5), pp. 632–651.

This article reviews research on innovation dissemination and organizations to suggest future research. A considerable amount of research has been conducted recently on innovation in organizations. The author describes four requirements necessary to undertake research on the process of change in general and on the innovation process in particular: (1) a clear set of concepts about the object being studied, (2) systematic methods for observing change in the object over time, (3) methods for representing raw data to identify process patterns, and (4) a “motor” or theory to make sense of the process. The authors are critical of past research and call for a focus on process research in future investigations and for moving from a stage-by-stage conception of the innovation process to a dynamic, continuous conception in which innovation variables are sequenced and analyzed over time. They adapt criteria from other studies to the case of innovation, suggesting four requirements for a theory of innovation: (1) it should explain how structure and purposive action are linked at micro and macro levels of analysis; (2) it should explain how innovation is produced both by the internal functioning of organization structure and by the external purposive actions of individuals; (3) it should explain both stability and instability; and (4) it should include time as the key historical metric.

- 27 Warner, K.E. (1975, Winter). A "Desperation-Reaction" Model of Medical Diffusion. *Health Services Research*, pp. 369-383.

This article briefly reviews knowledge about the adoption and diffusion of innovations. A "desperation-reaction" model is then proposed to explain how certain innovations, intended to address dire medical problems, might

diffuse in a manner not previously reported, with extensive diffusion occurring during what would be a period of small-scale experimentation and limited adoption in the conventional innovation-diffusion environment. The model is illustrated with findings from a case study of the diffusion of drug therapies for four types of leukemia. Possible applications of "desperation-reaction" diffusion to other medical areas are suggested.

Dissemination and Knowledge/Research Utilization

- 28 Backer, T.E. (1991, March). Knowledge Utilization: The Third Wave. *Knowledge: Creation, Diffusion, Utilization* 12(3), pp. 225–240.

Knowledge utilization—research and scholarly and programmatic intervention activities aimed at increasing the use of knowledge to solve human problems—is presently in its third wave of activity in the United States. Definitions of the field, a historical analysis of each of the three waves (1920–1960, 1960–1980, and the present), and an overview of the knowledge base on knowledge utilization are presented in a brief state-of-the-art review for this field as of 1990. Seven larger societal trends that will affect knowledge utilization in the 1990's are explored along with four significant challenges that the field will face internally, and some mechanisms for creative response are suggested. Knowledge utilization strategies represent only one aspect of the systemic interventions needed to alleviate societal problems and improve quality of life. Attention to the realities they address is critical, however, because so many problems go unsolved either because no one knows the solution exists, or barriers of individual or organizational dynamics interfere with the solution being implemented successfully. The author concluded that significant progress is being made during knowledge utilization's "third wave" on developing and refining—and using—these strategies in many public and private organizations.

- 29 Ballin, A.J., W.H. Breslin, K.A.S. Wierenga, and K.F. Shepard. (1980, July). Research in Physical Therapy: Philosophy, Barriers to Involvement, and Use Among California Physical Therapists. *Physical Therapy* 60(7), pp. 888–895.

This study was designed to determine the importance of research in physical therapy to professional physical therapists, to assess the factors impeding their involvement in research, and to examine the extent to which therapists read and use published research. The study was conducted in two parts—a

series of personal interviews (of 15 physical therapists) and a questionnaire developed from the results of the interviews. The sample for the interviews was drawn from the population of Santa Clara County, California, and the questionnaires were mailed to a random distribution of 300 physical therapists throughout the State of California. Lack of time and funding as well as unfamiliarity with both the research process and the use of statistics were cited as the main barriers to research involvement. Collaboration with other health professionals involved in research (79.6 percent) and in apprenticeships (68.6 percent) were listed as desirable methods to gain additional research skills; however, these were believed to be largely unavailable. A large percentage of therapists (75.8 percent) used research information published in professional journals other than *Physical Therapy*.

- 30 Bardach, E. (1984, December). The Dissemination of Policy Research to Policymakers. *Knowledge: Creation, Diffusion, Utilization* 6(2), pp. 125–144.

The author presents a conceptual model of how results of policy-relevant research are disseminated to policymakers, knowing that such "knowledge" does reach them in some form and in time for them to do something useful with it. Policymaking should be viewed as a craft, and as such, dissemination of policy-relevant knowledge must often be intermittent, and contingent on the development of specific situations in which certain kinds of knowledge (especially on what works) are needed. Key components to this process include the importance of the organizational and political context of policymakers on a daily basis and the cooperative relationship between consumers and producers when producers try to reduce the costs to consumers of obtaining information. The producers can facilitate access to information on the part of potential consumers through the use of a central storage arrangement. A discussion of the overall allocation of costs incurred for the dissemination of information revealed that the

financing of explicit dissemination activities on the part of knowledge producing organizations often comes from an outside governmental source. Finally, bureaucratic and professional influences can interfere with the optimal dissemination and use of research.

- 31 Bedell, J.R., J.C. Ward, Jr., R.P. Archer, and M.K. Stokes. (1985, April). An Empirical Evaluation of a Model of Knowledge Utilization. *Evaluation Review* 9(2), pp. 109–126.

Long time lags between development and use of scientific innovations have resulted in much theorizing about the process of knowledge utilization although there is little empirical evidence for the validity of these theories. The present research is a retrospective investigation of the relationships between eight A-VICTORY theoretical factors of knowledge utilization (based on the decision determinants model) and whether or not treatment innovations had been implemented in mental health agencies following consultation. Two versions of a Decision Determinants Questionnaire (DDQ) were administered to 177 and 223 mental health workers. Data were later collected from 213 people in 30 Florida mental health agencies who used the DDQ as well as performed level-of-use interviews (LOU); the results revealed significant relationships for four factors. Agencies adopting the procedures reported values and philosophies that are more similar to the values and philosophies embodied in the innovation. They reported more accurate information and knowledge about the new procedures and how to implement them, a stronger need for change, and that they had anticipated more benefit prior to adopting the procedures than did nonusers.

- 32 Bohannon, R.W. and B.F. LeVeau. (1986, January). Clinicians' Use of Research Findings: A Review of Literature with Implications for Physical Therapists. *Physical Therapy* 66(1), pp. 45–50.

This paper reviews the literature regarding research utilization by human service professionals, discusses factors that may contribute to utilization, describes

recommendations that have been suggested to increase research utilization, and makes suggestions for future investigations about research utilization by physical therapists. The literature suggests that research information is not used routinely by human service professionals. The nature of research communication, the training and personal characteristics of human service professionals, and the practice environments of human service professionals, such as physical therapists, probably influence the degree to which research is utilized. The author discusses specific interventions that may be effective at increasing research utilization by physical therapists.

- 33 Booth, T. (1990, September). Researching Policy Research: Issues of Utilization in Decision Making. *Knowledge: Creation, Diffusion, Utilization* 12(1), pp. 80–100.

This article addresses the problems of exploring the use of research in the policy process. Measuring the impact or outcomes of policy research raises complex methodological and conceptual issues. How the task is approached and what measures are used depend, for example, on how the nature of the policymaking process is conceived, on what functions research is presumed to play in the making of policy, and on the way in which the relationship between research and policy is presented. Drawing on the wider literature in this field, this article describes and illustrates the three main methods that have been used for studying research use in the policy arena—impact studies, insider accounts, and case studies—and examines their strengths and weaknesses.

- 34 Brett, J.L.L. (1987, November/December). Use of Nursing Practice Research Findings. *Nursing Research* 36(6), pp. 344–349.

Fourteen nursing research findings that meet the Conduct and Utilization of Research in Nursing (CURN) Project (1982) criteria for clinical use were identified from research journals and CURN publications for the years 1978–83. A stratified random sample of 216 practicing nurses in small, medium, and large hospitals was surveyed with a questionnaire designed to measure nurse adoption of the

research findings. Using Rogers' (1983) stages of innovation adoption as a guide, 7 questions measuring the nurse's stage of innovation adoption were developed for each of the 14 nursing practices. The results indicated that the majority of nurses were aware of the average innovation (from 34 to 95 percent), were persuaded about it (from 28 to 92 percent), and used the average innovation sometimes (from 31 to 93 percent); for all 14 innovations the number of nurses aware was greater than the number persuaded, the latter being greater than the number who adopted always. Ten of the 14 innovations were implemented by a majority of the nurses while from 6 to 79 percent of the nurses indicated they used a particular innovation always. The author concludes that research dissemination and use is occurring; however, use of the innovations had no relationship to hospital policies or procedures concerning the nursing research findings.

- 35 Brown, B.S. (1987). Networking Between Research and Service Delivery. *International Journal of the Addictions* 22(4), pp. 301–317.**

The author reviews the forces that impede the transfer of information and technologies from research to health service delivery, with reference to the field of drug abuse. Issues that appear to be general factors in efforts to change service delivery systems have been identified as (1) programmatic relevance of the planned initiative, (2) timeliness of the initiative, (3) communication style employed, (4) credibility of both the message and the messenger, (5) evidence of sufficient resources to guarantee the implementation of the initiative, (6) acceptability of the initiative so that it is not seen as a threat to the individual's job status and ability, and (7) the clear association of the planned initiative with organization goals of service delivery. Other factors include the service reliance on paraprofessional staff, treatments, and declining resources for service delivery. Strategies for overcoming these obstacles are explored with a particular view to translating research materials to a language and format appropriate to the field of service delivery. Also explored are issues in the study of competing strategies of knowledge transfer.

- 36 Champion, V. L., and A. Leach. (1989). Variables Related to Research Utilization in Nursing: An Empirical Investigation. *Journal of Advanced Nursing* 14, pp. 705–707.**

A correlational study was conducted to identify variables related to utilization of research in the clinical area. A convenience sample of 59 nurses from a community hospital in the southwest part of the United States was utilized for the sample. The concepts of attitude, support, and availability were identified through the literature and used as independent variables for this study (in questionnaires). Scales were developed from past research and tested for validity and reliability. Results indicated that attitude and availability were related to research utilization; in addition, the support of administrators was also important in determining research use. Results from this study can be used to develop strategies to increase research utilization.

- 37 Crane, J. (1985, May). Using Research in Practice Research Utilization: Theoretical Perspectives. *Western Journal of Nursing Research* 7(2), pp. 260–268.**

There has been heightened interest in the past decade in increasing the extent to which the method and outcomes of research influence nursing practice. Evidence shows that progress has been made in promoting inquiry within settings in which nursing is practiced and that the activities related to the conduct of research are becoming more common. In relation to research utilization, however, the extent of progress is less clear. This article gives an overview of four models that have applicability for research utilization in practice settings: research, development, and diffusion; social interaction and diffusion; problem solving; and linkage. These knowledge/research utilization models have been used and tested in three research utilization efforts funded by the Division of Nursing: the WICHE Regional Program for Nursing Research Development, 1975–77; the Conduct and Utilization of Research in Nursing (CURN) Project, 1975–81; and the Nursing Child Assessment Satellite Training Project, 1976–85. The models provide useful

frameworks for the utilization of nursing research and merit further testing and refinement.

- 38 David, S. (1991, March). Developing a Technology Transfer Program for the National Institute on Drug Abuse. *Knowledge: Creation, Diffusion, Utilization* 12(3), pp. 289-297.

Since 1989, the National Institute on Drug Abuse has been developing a systematic program of technology transfer to promote use of drug abuse research findings by practitioners in the field. The current program builds on activities conducted by the Institute since its founding in 1974, including research on the technology transfer process in drug abuse. Current technology transfer activities include a recent national conference, convening of an ad hoc committee on technology transfer, publication of research monographs, development of video-based learning packages, and design of a four-step process for promoting wider adoption of identified drug abuse research findings by drug abuse practitioners and treatment or prevention organizations. The Institute has developed a process to involve service providers in determining what kind of research findings are most useful for dissemination to improve the delivery of substance abuse services.

- 39 Edwards, L.A. (Undated.) *Using Knowledge and Technology to Improve the Quality of Life of People Who Have Disabilities: A Prosumer Approach*. Philadelphia, PA: Institute for the Visually Impaired, Pennsylvania College of Optometry. DOE Grant No. H133D80013-89.

This grant report explores the state of the art in knowledge utilization to determine its applicability to the rehabilitation field and provides comprehensive coverage of knowledge utilization from both the general and rehabilitation perspectives. Various factors, strategies, models, and findings of research utilization reported in the

multidisciplinary literature are examined and applied to the field of rehabilitation. The general literature included knowledge utilization studies in the fields of medicine and public health, psychology, sociology, rehabilitation, communications, gerontology, management, and education. The author offers a "prosumer" approach to knowledge utilization in order to bridge the gaps between researchers and practitioners as well as integrate other forms of knowledge to help fill gaps in scientific knowledge. This new approach acknowledges the interdependency, viability, integrity, and worth of all stakeholders (includes researchers and research utilization specialists as well as clients, educators, and policymakers) in the rehabilitation field by empowering them through equal access to information and equal opportunities to help develop the knowledge and technology that can improve the quality of life of people with disabilities. The publication includes a description of the Department of Education's dissemination infrastructure and program as well as a literature review and reference list.

- 40 Edwards-Beckett, J. (1990, November). Nursing Research Utilization Techniques. *Journal of Nursing Administration* 20(11), pp. 25-30.

The author reviews the literature to identify techniques for the facilitation of nursing research utilization. Nine general themes (not mutually exclusive) were employed to organize techniques and include (1) awareness of current literature, (2) dissemination of research findings, (3) the conduct of research, (4) interaction of clinicians and researchers, (5) educational techniques, (6) organizational promotion, (7) guiding committees, (8) provision of resources, and (9) rewards. The techniques within each theme could be implemented by individual nurses, small groups, or a health care institution or school. The review supports the need for the concerted efforts of researchers, practitioners, teachers, and administrators to implement research findings into practice.

- 41 Firlit, S.L., M. Walsh, and M.G. Kemp. (1987, November). Nursing Research in Practice: A Survey of Research Utilization Content in Master's Degree Programs. *Western Journal of Nursing Research* 9(4), pp. 612–616.

A survey was sent to 129 National League for Nursing-approved graduate programs throughout the United States to determine the extent to which the research utilization process is incorporated in graduate nursing curricula. The findings from 96 respondent schools (74 percent) reveal that 94 percent of the master's degree programs include content about research utilization in required courses, while only 15 percent cited readings specifically related to the research utilization process. Although 63 percent stated that students were required to develop proposals for clinical trials and 42 percent indicated that students were required to implement clinical trials, only 14 percent reported that they taught a specific research utilization process. The data appear contradictory in some areas and suggest that individual respondents may have interpreted the term "research utilization" differently. The authors suggest that faculty may want to re-examine the relationship of teaching strategies to the terminal objectives of their program in order to better prepare the master's degree graduate to apply research-based knowledge in clinical settings.

- 42 Friedman, L., N.K. Wenger, and G.L. Knatterud. (1983). Impact of the Coronary Drug Project Findings on Clinical Practice. *Controlled Clinical Trials* 4, pp. 513–522.

This article examines the effectiveness of several approaches (predominantly presentations at scientific meetings and reports in peer-reviewed journals) to communicate findings from the Coronary Drug Project (CDP), on clinical management of post-myocardial infarction (MI). From 1979 to 1981, 1,785 randomly selected physicians (587 cardiologists, 584 internists, and 614 general or family practitioners) who treated patients recovered from MI were interviewed on their familiarity with the CDP and their prescription of lipid-lowering drugs. Over 42 percent of the physicians indicated general

awareness of the CDP; this percentage was higher for cardiologists and lower for general practitioners. Physicians with greater knowledge of the CDP findings were less likely to prescribe clofibrate for post-MI patients. For those physicians without knowledge of the findings, 73.1 percent prescribed clofibrate and 12.5 percent most often prescribed cholestyramine, whereas for those with knowledge of the findings, these figures were 45.5 percent and 31.8 percent, respectively. Over time there was a trend of decreasing routine prescription of lipid-lowering drugs by all physician groups—especially of clofibrate. CDP findings were only gradually transmitted to practicing physicians, with a considerable time lag between the publication of the findings, their assimilation, and their application in clinical practice. The authors suggest that investigators must use many mechanisms to communicate findings maximally and that public health leaders and policymakers should share responsibility of educating practitioners in the clinical implications of findings.

- 43 Friedman, M.A. and Z.E. Farag. (1991, March). Gaps in the Dissemination/Knowledge Utilization Base. *Knowledge: Creation, Diffusion, Utilization* 12(3), pp. 266–288.

This article describes and discusses three major gaps that hinder knowledge dissemination and utilization. The gaps concern the structure of the field, the processes by which the dissemination literature is aggregated, and the lack of information about who uses the knowledge that has been disseminated and its effect on behavior and society. Further delineation is given through discussions of specific deficiencies, such as problems created by the information explosion and the methods and policies governing organization of the literature. The authors suggest several steps to remedy the gaps and offer recommendations and areas for future research. They conclude that literature syntheses are needed to tie together the many fields related to effective dissemination, and that additional research should be done on alternative dissemination mechanisms.

- 44 Fuhrer, M.J. (1983, December). Communicating and Utilizing Research in Medical Rehabilitation. *Archives of Physical Medicine and Rehabilitation* 64, pp. 608-610.

The purpose of medical rehabilitation is to enhance the knowledge foundation of medical rehabilitation practice so that improved service outcomes are achieved. The commentary deals with the problem of transforming applied research knowledge into practice knowledge, but not with the larger issue of how practice knowledge is transmitted and utilized. The author considers the process of dissemination and utilization of research and its relationship to medical rehabilitation, and gives recommendations for improving transmission efficiency of research information.

- 45 Goode, C.J., M.K. Lovett, J.E. Hayes, and L.A. Butcher. (1987, December). Use of Research Based Knowledge in Clinical Practice. *Journal of Nursing Administration* 17(12), pp. 11-18.

The authors describe three research utilization projects by applying a knowledge-driven approach to nursing practice, using a temperature study, a breastfeeding study, and a preoperative teaching study. The activities involved in developing and implementing these research utilization projects included (1) preparing nurses to read, critique, and use research; (2) identifying and reviewing research studies in a common area to develop a research base; (3) transforming the research-based knowledge into a protocol to be used in the clinical area by nurses caring for patients; and (4) evaluating the protocol to see whether it is being implemented as expected and whether it is producing the predicted results. This practical use of research to change nursing practice is discussed and illustrated through a systems theory model to encourage nurses to use research.

- 46 Knott, J. and A. Wildavsky. (1980, June). If Dissemination is the Solution, What is the Problem? *Knowledge: Creation, Diffusion, Utilization* 1(4), pp. 537-578.

This article identifies three obstacles to use of knowledge by decisionmakers: (1) knowledge

needed by decisionmakers does not exist, (2) decisionmakers are ignorant of knowledge that does exist, and (3) decisionmakers know about knowledge but refuse to utilize it. The authors discuss how these obstacles might be overcome to ascertain what dissemination strategies will increase the use of knowledge. By determining if and how underutilization of knowledge is a problem, the question of whether dissemination is a proper solution is discussed. The authors conclude that (1) dissemination can be a solution to the problem of underutilization if knowledge is disseminated to particular clienteles under specific circumstances; however, premature dissemination in the absence of knowledge contributes to information overload, making dissemination a cause of underutilization rather than a cure; (2) dissemination should not substitute for available information when natural processes are cheaper and more effective; (3) artificial dissemination is needed when natural dissemination fails; and (4) the urge to disseminate should be combined with analysis that aims at better screening. Defining the role of dissemination demands that a connection be made between the problems of utilization and specific strategies that contribute to their solution at a reasonable cost.

- 47 Krutzsch, C.B., T.C. Bellicha, and S.R. Parker. (1987, Fall). Making Childhood Asthma Management Education Happen in the Community: Translating Health Behavioral Research into Local Programs. *Health Education Quarterly* 14(3), pp. 357-373.

One recent outcome of health behavior research has been identification of the skills needed by children and parents to manage childhood asthma effectively. Several methods for teaching these skills were developed by the National Heart, Lung, and Blood Institute (Open Airways, Air Power, Living with Asthma, and Air Wise) and by the American Lung Association (Superstuff), and were tested on hundreds of families in a variety of health care settings. The programs teach attack prevention and control skills, and emphasize coping skills that help families deal with the behavioral factors impinging on asthma management and compliance with

medical advice. The authors describe a technology transfer project to facilitate community adoption of these programs. The project was highly successful in introducing local health professionals to the new concepts and tools of pediatric asthma education and stimulating introduction of education programs in a large number of health care settings across the United States. Elements of success include the introduction of the new concepts to health professionals in a way that fostered acceptance, the use of seed money and free materials, the use of key decisionmakers and organizations in the community for implementation, and workshops that focused on learning needs and practical implementation aspects.

- 48 Kunzel, C. and D. Sadowsky. (1989, September). Knowledge Acquisition Processes: Dissemination of Expert Recommendations to General Practice Dentists. *Journal of Health and Social Behavior* 30, pp. 330–343.

In this article, the authors explained the variation in dentists' knowledge of the most recent American Heart Association recommendations for the prevention of bacterial endocarditis and the learning processes involved in order to improve the level of knowledge. Using data from a 1986 national telephone survey of 578 respondents (81 percent response rate, from a disproportionate, stratified random sample), the authors developed and analyzed a structural model (Trimmed Path Model) in which the contributions to knowledge by age, professional practice settings, colleague networks, and formal educational experiences were investigated. The overall knowledge level of respondents to the recommendations was quite low in this study (somewhat lower than physicians). This difference could be due to dentists' lack of involvement with life-threatening or systemic diseases and fewer occasions to write prescriptions. The findings also showed that age, conditions of practice, and practice-based collegial relationships were direct contributors to knowledge while formal professional channels or re-education did not contribute directly to knowledge level; instead, their effect is expressed through institutional affiliations. The authors note the

lack of research on knowledge acquisition among dentists, especially practicing dentists, and suggest future research topics.

- 49 Larsen, J.K. (1985, December). Effect of Time on Information Utilization. *Knowledge: Creation, Diffusion, Utilization* 7(2), pp. 143–159.

The researcher studied information use, defined as the decision made by a local organization to use or not use specific information, in a nationwide sample of 39 local mental health agencies over an 8-month period. Eighteen consultants, each visiting two or three centers, conducted sessions with staff and provided information on the topic, both research-based information and general information. Approximately 75 percent of the ideas provided to local organizations were used or being implemented; only 25 percent of the ideas were disregarded. Two findings are that (1) information use takes time—organizations were in the process of making decisions 8 months after presentation of the information and (2) high rates of information use are likely to be associated with information that is relatively easy to implement.

- 50 MacGuire, J.M. (1990). Putting Nursing Research Findings Into Practice: Research Utilization as an Aspect of the Management of Change. *Journal of Advanced Nursing* 15, pp. 614–620.

The author discusses a number of different levels at which the implementation of nursing research findings needs to be addressed and identifies 10 areas of potential difficulty: (1) the complexity of the change process; (2) the genesis of research programs; (3) the formulation of research questions; (4) differences in theoretical approaches; (5) time scales and planning cycles; (6) information overload; (7) credibility; (8) applicability; (9) response to change; and (10) the management of change. An attempt is made to shift the nature of the discourse from the personal to the organizational and from a diffusionist perspective to that of change management. It is suggested that it is simplistic to regard the apparent lack of use of research-based practice findings as a failure on the part of individual

nurses to respond rationally to the production of new information. The integration of research and practice has to be addressed at all levels within an organization—from policy statements to procedure manuals and from managers, educators, and clinicians to support workers within the framework of the management of change.

- 51 Nelson, C.E. and L.C. Mullins. (1985, Summer). Knowledge Utilization in Gerontology: The Example of Long-Term Care. *Gerontology & Geriatrics Education* 5(4), pp. 17–27.

This paper discusses how findings from the field of knowledge utilization can be applied to gerontology and to long-term care. The authors discuss the diffusion of innovations, the linkage model of dissemination, the innovative organization model of change, the use of information by policymakers, and the use of evaluation. In long-term care, information that is considered comes from (1) mass media information about aging and nursing homes, (2) colleagues who hold similar jobs in other facilities or agencies, and (3) continuing education as it pertains to specific topics. Whether the information results in innovative programmatic changes is contingent on the goals and structure of the organization. What is needed is a linkage agent that can facilitate multiple interfaces between (a) members of academia and care providers; (b) members within a particular organizational subgroup, for example, between nursing home administrators, home health care agencies, and case managers; (c) horizontally related providers, for example, nursing home administrators, physicians, and community care providers; and (d) policymakers, especially at the State level. Recommendations on how this can be applied to gerontology, and ways for gerontologists to become involved in knowledge utilization are discussed.

- 52 Orlandi, M.A. (1987). Promoting Health and Preventing Disease in Health Care Settings: An Analysis of Barriers. *Preventive Medicine* 16(1), pp. 119–130.

Changes in lifestyle that promote health-enhancing behaviors and inhibit health-

compromising behaviors have been recommended by the Surgeon General as an integral means of improving the health of the Nation. A variety of innovations including new knowledge, products, and services have been developed with this recommendation in mind. A major objective of these efforts is to identify settings for effective diffusion and adoption of these new approaches into population groups that can make use of them. Health care settings such as hospitals, clinics, community health centers, health maintenance organizations, and private physicians' offices offer unique possibilities in this regard. Though opportunities exist for promoting health and preventing disease in settings such as schools and worksites, the primary objectives of such organizations are unrelated to health. This article reviews the opportunities for health promotion and disease prevention in health care settings. It identifies a range of barriers to such efforts, including barriers to dissemination and implementation as critical steps in the knowledge transfer process. Strategies for overcoming these barriers are described within the context of general linkage theory.

- 53 Solomon, M.A. and S.M. Shortell. (1981, Fall). Designing Health Policy Research for Utilization. *Health Policy Quarterly* 1(3), p. 216–237.

The authors examined the role of policy research in the development and implementation of health policies. Effective public policies are critical in an era of limited resources. Research cannot ensure the success of policy, although it can minimize failure by providing a rational decisionmaking framework. The conduct of high quality research is not sufficient in itself to ensure its utilization—the policy researcher has the responsibility for facilitating use. Even under the most ideal conditions, utilization and effect are influenced by many factors, including (1) the style by which policy is communicated, (2) organizational and political factors, (3) the availability of the research in a time frame consistent with the decisionmaking process, and (4) the client commitment to the research. The authors review the literature on the dissemination and utilization of research, although much of it, as it pertains to

policymakers, is concerned with the dissemination of evaluation studies. The usefulness of policy research can be expanded by studies that directly address information needs of policymakers and appropriate dissemination plans.

- 54 Stetler, C.B. (1985, Spring). Research Utilization: Defining the Concept. *Image: The Journal of Nursing Scholarship* 17(2), pp. 40–44.

The author examines the definition of research utilization as it relates to the broader concept of knowledge utilization and reviews the state of the art of research utilization within the nursing profession. Specific models—WICHEN project, CURN project, King and colleagues model, and Stetler and Marram's model—that designate how utilization should ideally occur within nursing are presented along with an exploration of the congruency of such models with descriptive data and related conceptualizations currently available in the general research literature. Despite differences in the approaches or definitions of research utilization, (1) all models were developed as implicitly prescriptive models and indicate what research utilization should be, and (2) none has yet been adequately evaluated. The author concludes that the nursing profession needs more information on how and when research can most effectively promote scientific practice within the framework of the broader concept of knowledge and its utilization.

- 55 Webber, D.J. (1986, March). Explaining Policymakers' Use of Policy Information: The Relative Importance of the Two-Community Theory Versus Decision-Maker Orientation. *Knowledge: Creation, Diffusion, Utilization* 7(3), pp. 249–290.

The analysis of policy information use by Indiana State legislators considers the relative importance of legislators' job images compared with the importance of their basic worldview and personal attitudes and attributes. Divided into five sections, the article presents (1) a general causal model of legislators' use of policy information consisting of four rival hypotheses; (2) a discussion of the definition and measurement

of "policy information use"; (3) the two-communities theory and a review of the results of previous research; (4) legislators' objectives, job-images, and attributes considered in the causal model; and (5) a formulation and estimation of a causal model of legislators' use of policy information. Forty percent of the Indiana legislators thought there is widespread use made of policy research to assist in formulating better policy, whereas 53 percent responded "occasionally" and 7 percent said "never." The major implication of this analysis for increasing legislators' use of policy information is the importance of constituent and electoral factors in shaping legislator choice.

- 56 Weiss, C.H. (1983). Ideology, Interests, and Information: The Basis of Policy Positions. In Callahan, D. and B. Jennings (Eds.). *Ethics, The Social Sciences, and Policy Analysis*. New York: Plenum, pp. 213–245.

This article discusses historical views of policy research along with the premise that the public policy positions taken are the result of three sets of forces and their interactions: ideologies, personal interests (for example, in power, reputation, financial reward), and available information. Studies of the consequences of social science research led to a reconceptualization of the role of research in the policy process that tend to affirm that immediate and direct linkages between study results and policy decisions are relatively rare. The recognition that research often makes significant conceptual contributions may reduce the sense of futility that has afflicted policy researchers, but it does not resolve the issue of how to increase the use of research information in policymaking. The author contends that such a definition of the question is likely to be unproductive unless competing sources of influences are taken into account (that is, information, ideology, and interests). The author concludes that to predict whether research will influence policy either in the short term or through gradual redefinition of interests and ideologies is a difficult and complex undertaking; future investigations that try to tackle the question should give explicit attention to the configuration of ideologies, interests, and existing information.

- 57 Weiss, C.W. and M.J. Bucuvalas. (1980, April). Truth Tests and Utility Tests: Decision-Makers' Frames of Reference for Social Science Research. *American Sociological Review* 45, pp. 302–313.

To contribute to an empirically based “sociology of knowledge application,” the authors explore the frames of reference—the criteria for accepting or rejecting the results of research—that decisionmakers employ in assessing the usefulness of social science research for their work. Analysis of responses of 155 decisionmakers (51 Federal, 52 State, and 52 local officials) in mental health fields to 50 research reports reveals 5 frames of reference: (1) relevance of research topic; (2) research quality; (3) conformity of results with

expectations; (4) orientation to action; and (5) challenge to existing policy (status quo)—all frames are positively associated with perceived likelihood of using a study. Two significant interactions among the frames suggested that, in essence, decisionmakers apply a “truth test” and a “utility test” in screening social science research. They judged truth on two bases: research quality and/or conformity with prior knowledge and expectations. They assessed utility on alternative bases: feasible direction for action and/or challenge to current policy. The authors conclude that the ways in which decisionmakers apply social science research findings to their work is a broader, more diffuse, and a wider-ranging process than many earlier investigators have recognized.

Communications and Information Sources

- 58 Aaronson, N.K., D.H. Ershoff, and D.M. Wilner. (1985, March). Reducing Access Barriers to the Use of Reading-Based Information: A National Intervention with Community Mental Health Center Executives. *Knowledge: Creation, Diffusion, Utilization* 6(3), pp. 225–248.

Results are reported for a national study conducted to determine whether community mental health center (CMHC) executives would increase their use of the social science literature for policymaking if it were more accessible, say through a computer-based bibliographic retrieval system (CBBRS). The study population consisted of mental health professionals working in 476 federally funded CMHC's listed in the 1977 NIMH Directory. The study group of 476 mental health professionals—one drawn randomly from each CMHC—was initially contacted by mail with a baseline questionnaire. Eventually, a majority of the self-selected subgroup of 171 respondents who accessed the social science literature for one search through CBBRS reported that they had used their retrieved materials for both conceptual and instrumental purposes. Furthermore, the positive experiences reported with regard to the study-specific search were mirrored in a more general assessment of the potential usefulness of such a CBBRS in meeting future information needs. The study drew two conclusions: (1) problems of access are definitely a barrier to be overcome by many CMHC executives who desire to use the current social science literature and (2) the commercial cost of accessing the literature via CBBRS would often be prohibitive to many community-based mental health programs.

- 59 Blanpain, J.E. (1986). Transfer of Technology Assessment to Health Policy Makers. *International Journal of Technology Assessment in Health Care* 2(1), pp. 117–125.

The changing role of technology assessment, in relation to health policymaking, has implications for the transfer of assessment findings to the parties involved in the process

of policymaking. The author discusses the need for new communication patterns and appropriate media and examines some of the emerging transfer mechanisms. These mechanisms include environmental assessment and scenario-building to relate technology assessment to the wider context of policymaking, health policy journals in which health services research findings could be disseminated, and health policy forums, to bring together different segments of the health sector to exchange information.

- 60 Cohen, L.H. (1979, December). The Research Readership and Information Source Reliance of Clinical Psychologists. *Professional Psychology* 10(6), pp. 780–785.

A mail survey was conducted of clinical psychologists (224 respondents) employed in various work settings to determine the extent to which clinicians read research articles and/or rely on other sources of information for their professional work activities. The results indicated that academic clinicians and medical school psychologists read slightly more than four research articles per month, while the other psychologists read slightly more than two articles per month. Furthermore, the groups of psychologists differentially rely on such information sources as nonresearch articles and workshops. The findings are discussed in the context of mental health research utilization and mental health innovation. The data suggest that attempts to diffuse mental health innovations should rely on those information sources most likely to be consulted by particular groups of clinicians, and that diffusion efforts should be nearly as diverse as the sources relied upon.

- 61 Connelly, D.P., E.C. Rich, S.P. Curley, and J.T. Kelly. (1990). Knowledge Resource Preferences of Family Physicians. *Journal of Family Practice* 30(3), pp. 353–359.

This article discusses the pivotal role of medical knowledge in clinical problem solving, how clinicians decide to seek additional knowledge for patient care decisions, and how they choose among the

resources available to them. Using a self-administered questionnaire, 126 family physicians reported use of 11 types of knowledge resources for answering patient-specific questions in clinical practice. Findings include (1) almost daily use of the *Physician's Desk Reference* and more than weekly use of colleagues, (2) little use of *Index Medicus* or computer-based bibliographic systems, and (3) infrequent use of medical research literature, (rated the lowest of resources in terms of credibility, availability, searchability, understandability, and applicability). Resource cost variables related to clinical availability and applicability of the information appeared to be more influential than quality factors of the resource. Despite limitations of this study (self-reported use, a possible nonrepresentative 52 percent response rate, and absence of some resource, knowledge seeker, and task characteristics likely to be influential in determining use) the overall consistency of response patterns between family physicians and internists and the good correlation with other studies suggest that these results are valid and generalizable. The authors conclude that knowledge resources must be close to the clinical action, relevant in content, and clearly presented.

- 62 Ferguson, K.J. and R.M. Caplan. (1987, January). Physicians' Preferred Learning Methods and Sources of Information: Do Self-Identified Independent Learners Differ from Course Participants? *Möbius* 7(1), pp. 1-8.

To determine whether self-identified independent learners differed significantly from their colleagues regarding preferred learning methods or sources of information, this study assessed a total of 97 physicians including 61 physicians who scheduled independent learning activities through the University of Iowa Office of Continuing Medical Education and 36 physicians who attended a traditional continuing medical education (CME) refresher course. Both groups rated learning methods similarly, scored the same on an adapted version of Stone's Preferred Learning Style Index and rated information sources similarly. The groups differed somewhat in terms of how preferred learning methods and sources of

information related to time spent on-call and time spent in leisure activities. The authors suggest that future researchers explore learning style in relation to the content to be learned, determine preferred learning methods and sources of information, and then plan educational activities, rather than view learning style as a global construct. Finally, there is a need to consider which methods work best with cognitive, affective, or psychomotor objectives and then offer educational options to learners that will enable them to meet learning objectives effectively and efficiently.

- 63 Fineburg, H.V., R.A. Gabel, and M.B. Sosman. (1978, June). Acquisition and Application of New Medical Knowledge by Anesthesiologists: Three Recent Examples. *Anesthesiology* 48(6), pp. 430-436.

This early study describes and analyzes dissemination of three medical findings and associated changes in clinical practice among 354 anesthesiologists (56 percent response rate of 631) in Massachusetts. The findings dealt with (1) potential hazards of subanesthetic concentrations of anesthetic gases, (2) problems caused by diffusion of nitrous oxide into body cavities, and (3) increased blood loss during therapeutic abortion with halothane anesthesia. Nearly all responding anesthesiologists were aware of these findings, but the patterns of dissemination were quite different. For the first finding only, there was marked acceleration in the spread of awareness following initial publication; however, the average delay between awareness and change in practice was much greater for it than for the other two findings. For all of the findings, continuing education courses were a source of information less than were colleagues or published papers; journal articles were a dominant source of information only for the first finding. Anesthesiologists were equally likely to change practice in response to a new finding whether they learned the information from published papers, colleagues or continuing education courses; board-certified anesthesiologists tended more than others to rely on papers, and younger anesthesiologists tended more than the older to be influenced by information from colleagues.

- 64 Fuhrer, M.J., and M. Grabois. (1988, March). Information Sources that Influence Psychiatrists' Adoption of New Clinical Practices. *Archives of Physical Medicine and Rehabilitation* 69, pp. 167–169.

In a mail survey, 343 psychiatrist members of the American Academy of Physical Medicine and Rehabilitation were queried regarding information sources that influenced their introducing a clinical innovation into practice in the past 2 years. Considered across all practice innovation categories, the average relative importance (in descending order) of the information sources was as follows: (1) discovery in the individual's own practice; (2) a meeting, lecture, or continuing education course; (3) a clinical coworker; (4) a writeup in the clinical literature; (5) the individual's own research; (6) a patient; (7) a writeup on the research literature; (8) a textbook; and (9) the representative of a drug firm or equipment manufacturer. Of the total, 43 psychiatrists reported introducing no innovation in the previous 2 years. Particular information sources are probably more relevant to some steps in the adoption process than others although the survey did not distinguish initial awareness of the innovation from succeeding steps. As a result, the reported overall usage of one source versus another probably blurred differences that otherwise might have been associated with specific steps in the adoption process. The results of this study are consistent with research of practice changes by other practitioners showing the importance of face-to-face contact among clinicians in making changes.

- 65 Gruppen, L.D., F.M. Wolf, C.V. Voorhees, and J.K. Stross. (1987). Information-Seeking Strategies and Differences Among Primary Care Physicians. *Möbius* 7, pp. 1–9.

To examine the extent of the differences in information preferences in primary care settings, 98 general internal medicine physicians and 73 family physicians were asked to indicate which of six alternative information sources they relied on most when faced with difficult medical problems:

journals, textbooks, informal consultations with community specialists, consultations with outside specialists, and transfer of the patient to another physician. The results indicated that primary care internists have a greater preference for consulting the medical literature (49 percent for textbooks, 14 percent for colleagues), while family physicians more often rely on colleagues (33 percent) and specialists (32 percent) as sources of information (27 percent for textbooks). These differences suggest that the focus of information dissemination through journals or textbooks may be more effective for internists, while colleagues or educationally influential physicians ("opinion leaders") may be more effective vehicles for dissemination to family physicians. The authors conclude that planners of continuing medical education information and dissemination strategies should take into account the various sources of information that physicians use when attempting to communicate advances to practicing physicians.

- 66 Haynes, R.B., D.L. Sackett, and P. Tugwell. (1983, October). Problems in the Handling of Clinical and Research Evidence by Medical Practitioners. *Archives of Internal Medicine* 143(10), pp. 1971–1975.

The authors discuss problems in the accuracy with which medical practitioners collect, interpret, communicate, and apply clinical, paraclinical, and relevant research evidence in the care of their patients. According to the article, many of these problems can be avoided or alleviated by applying some specific measurement principles and information tools, including (1) the collection of clinical evidence—improved by adhering to strategies that reduce observer error; (2) the interpretation of clinical and paraclinical information—improved by harnessing the predictive value of this information to estimates of the diagnosis, prognosis, and therapeutic responsiveness of patients; and (3) communication—improved by the use of more precise probabilities and terminology. The authors suggest guidelines to facilitate detection of both valid and useful new knowledge.

- 67 Leonard-Barton, D. (1984, September). Diffusing Innovations When the Users Are Not the Choosers: The Case of Dentists. *Knowledge: Creation, Diffusion, Utilization* 6(1), pp. 89–111.

In the flow of innovations from supplier to user, professionals serve as intermediaries in selecting new technologies and products. Using prosthodontists, this article explores a number of issues this situation raises regarding new product development and dissemination. In the first of 3 phases, 14 innovations and the major criteria used in evaluating them were identified by interviewing 20 crown and bridge experts on the East and West coasts and by analyzing the professional literature. The second phase consisted of (a) a questionnaire-survey of 300 members of the Academy of Crown and Bridge, evaluating the innovations on 21 characteristics, and (b) a telephone interview with 52 Cambridge, Massachusetts, dental patients about their experience with dentists and their evaluation of dental innovations. The final phase involved a nationwide survey of a random sample of 300 members of the American College of Prosthodontists and the American Prosthodontic Society as to what influences shape the dentists' evaluations of innovations. The article examines the rate of diffusion of dental innovations, the relationship between the innovations' characteristics and their usage, and differences between dentists' and patients' evaluation of the innovations. The findings indicate that the presence of intermediaries in the diffusion process complicates both the development and dissemination of innovations.

- 68 Lockyer, J.M., J.T. Parboosingh, G.M. McDougall, and U. Chugh. (1985, April). How Physicians Integrate Advances into Clinical Practice. *Möbius* 5(2), pp. 5–12.

The authors examined family physicians' perceptions of the sources of information and the time frame involved in adopting an innovation and compared the results with those obtained from specialists. Seventy-four family physicians and 86 specialists from Canada were asked to identify the sources of information they used in making changes in their clinical practices. While physicians

identified journals, courses, pharmaceutical representatives, colleagues, and consultations frequently as initial sources of information, the anticipated benefit to patient care was most frequently identified as the final motivating factor. Sociodemographic factors including specialty, age, community size, and base hospital were found to influence the information sources used by physicians to integrate advances into their clinical practices. A total of 342 changes were described (150 by family physicians), with an average of 3.08 sources of information utilized for each change (family physicians averaged 2.9 sources per change and the specialists 3.3); over 50 percent of the changes were complete in less than 1 year. These findings confirm the findings of other studies that physicians rarely change their practice immediately on learning new information, and CME providers should anticipate that the effect from a single educational event is likely to be small.

- 69 Maxwell, J.A., P.G. Bashook, and L.J. Sandlow. (1984). The Role of Communication Networks in Physicians' Adoption of Innovations. In *Proceedings of the Twenty-Third Annual Conference: Research in Medical Education: 1984*. Chicago, pp. 231–236.

This paper reports initial findings on the structure and role of communications networks in five physician communities, with findings drawn from the preintervention phase of a larger study on diabetes care concerning the influence of physician communication networks on patient care practices. The results are based on more than 30 semistructured, open-ended audiotaped interviews with physicians at 6 hospitals and on a subsequent 10-page questionnaire returned by over 250 physicians affiliated with 5 hospitals. The results suggest that the increase in subspecialization in medicine over the last 30 years, and the concomitant rise of the hospital as an organizing institution of care (rather than simply a place where physicians treat their own patients), have had a major effect on physicians' communication networks. Communication networks for diabetes information are hierarchical and "radial," rather than interlocking. Physicians practicing primary care medicine rarely reported that

they knew how other physicians treated their diabetic patients and appeared to rely almost entirely on specialists for advice on managing diabetic patients. The authors' tentative conclusion is that patterns of physician communication about new medical developments are shifting from a highly interconnected network to a more hierarchical and less interconnected one with information flow primarily from subspecialists to primary care practitioners.

- 70 Menzel, M. (1981). *Interpersonal and Unplanned Communications: Indispensable or Obsolete?* In E.B. Roberts, R.I. Levy, and others (Eds.). *Biomedical Innovation*. Cambridge, MA: The MIT Press.

The author contends that despite advances in information engineering, interpersonal and unplanned (informal) communications must continue to play their crucial role in science and technology, with formal steps taken to maximize these encounters. The advantages of interpersonal communication, the types and advantages of unplanned acquisition of information, formal analogs of informal communication features, and the limitations to the formal communication system are described.

- 71 Moore-West, M., D. Northup, B. Skipper, and D. Teaf. (1985). *Information-Seeking Behavior Among Physicians Practicing in Urban and Nonurban Areas*. In *Proceedings of the Twenty-Third Annual Conference—Research in Medical Education: 1984*. Albuquerque, NM, pp. 237–242.

This study assessed the effect that practicing in an urban or nonurban area might have on the information-searching behavior of physicians. Sixty percent of a stratified, random sample of 497 New Mexico physicians, drawn on the basis of specialty and geographical area, responded to telephone interviews in which they described the most recent instance in which they needed information. The sample was divided into three groups based on population density and was evaluated using the Critical Incident Technique. The results indicated that (1) physicians' questions more frequently arise

from their practice and are concerned with patient care and clinical science; (2) physicians tend not to utilize libraries, but rely on their own personal files; (3) physicians in urban areas relied more heavily on written resources and asked questions primarily out of a research interest; (4) of the physicians interviewed, academic and Federal employees were most likely to read the most recent updated information; and (5) rural physicians were more prone to seek information from colleagues. The authors suggest that continuing medical education seminars may go beyond offering new information by providing additional professional resources for rural physicians.

- 72 Osiobe, S.A. (1985). *Use of Information Resources by Health Professionals: A Review of the Literature*. *Social Science Medicine* 21(9), pp. 965–973.

The use of information resources by health professionals and their information-seeking behavior are comprehensively reviewed from a wide range of existing literature. The review highlights the influence of several variables on the use of different information sources by different types of health professionals: (1) form of practice, (2) engagement in research and educational programs, (3) a professional's age, (4) locus of practice, (5) accessibility, and (6) specialty and departmental affiliation. Different sources of information cited include journal articles, informal collegial communication, computerized bibliographic services, continuing medical education, and libraries. Specific findings of various studies are presented on these variables and their effect on information use by practitioners. The author discusses some of the problems that limit the free flow of health information in general as well as the problems of medical education and how these relate to information dynamics in the sciences.

- 73 Sadowsky, D. and C. Kunzel. (1988, Summer). *Predicting Knowledge Acquisition in Two Clinician Groups: Rethinking the Standard Paradigm*. *Knowledge in Society* 1(2), pp. 58–68.

The focus of this study was an innovative antibiotic preventive regimen recommended

by the American Heart Association and regularly updated. Data about knowledge of this regimen and potential predictors of knowledge levels were obtained from stratified random samples of 120 urban and 97 rural general dental practitioners in New York State. Using multivariate analyses, four research objectives were achieved: (1) measurement of clinicians' level of knowledge in both groups; (2) identification of personal and professional work and communication factors influencing clinicians' knowledge level; (3) assessment of the effect of each of these factors on knowledge; and (4) differentiation between sets of predictors for each group. The study has shown that the nature of the practice setting (that is, urban versus rural) has an effect on acquisition of this innovative knowledge. The positive effect on knowledge level of the particular worksetting accompanied by the necessity for a community of colleagues who share information argues for explanatory factors that are specific, situational, and/or ecologic. This is contrary to earlier studies of drug adoption that have viewed clinicians as being in a more or less monolithic profession. The role of distinct configuration of communication networks in the knowledge acquisition process is noted.

- 74 Stinson, E.R. and D.A. Mueller. (1980, January). Survey of Health Professionals' Information Habits and Needs. *Journal of the American Medical Association* 243(2), pp. 140-143.

Interviews with 402 randomly selected Alabama health professionals identified the information habits they used to stay abreast of current advances in medicine. The use of various information sources was related to such factors as their type of practice, specialty, location of practice, professional's age, and the size of their primary hospital. Medical literature was the most common source of information, with the typical health professional spending a mean of 5.5 hours per month using medical journals. In addition, the typical responder spent 1-5 hours per week in discussions with colleagues, 5-10 hours per year at local professional meetings, 5-10 hours per year at State meetings, and 10-15 hours per year at national meetings and

educational courses sponsored by various medical schools. Unsolicited medical literature was used extensively, particularly by those in rural, solo practice.

- 75 Stross, J.K. (1987, May/June). Information Sources and Clinical Decisions. *Journal of General Internal Medicine* 2(3), pp. 155-159.

This study assesses the dissemination of information on management of chronic airway obstruction (CAO) in small community hospitals, and it describes how formal continuing medical education (CME), informal communications with colleagues, medical journals, pharmaceutical manufacturers' representatives, and other information sources influenced physicians' behavior. The charts of all patients with CAO discharged from 6 hospitals were audited at 2 points in time, in 1978 (746 of 758 eligible charts) and 1983 (960 of 994 eligible charts). In addition, 85 physicians (40 internists, 45 family physicians) were surveyed to determine what information sources were critical in changing their behavior. Significant changes were seen in the use of diagnostic tests and therapeutic agents in that CME played a key role in test ordering, and pharmaceutical manufacturers' representatives were important sources of information concerning new therapeutic agents. The author concludes that the dissemination of information is a complex process and physicians frequently use multiple sources of information (formal CME, communications with colleagues, journals, textbooks, and pharmaceutical manufacturers' representatives) in the decisionmaking process.

- 76 Stross, J.K. and W.R. Harlan. (1979, June). The Dissemination of New Medical Information. *Journal of the American Medical Association* 241(24), pp. 2622-2624.

Dissemination of new medical information to practicing physicians is a complex and often faulty process. To examine the magnitude of this problem, a survey of 228 primary care physicians was performed to determine their knowledge of the results of a cooperative, randomized trial of photocoagulation in diabetic retinopathy—a study of the efficacy

of photocoagulation in more than 1,700 patients. Despite the acknowledged relevance to their practice, only 28 percent (38/137) of family physicians and 46 percent (42/91) of internists were aware of the study's results. Respondent physicians were also asked to manage two patient problems involving diabetic retinopathy. The results reveal that only 33 percent (75/228) chose the correct treatment for both patients, including 27 percent (12/45) of board-certified family physicians and 47.5 percent (19/40) of board-certified internists. The findings of this study, though limited in size and scope, indicate that results from clinical trials may not be disseminated to practicing physicians and, therefore, not incorporated into practice. Greater attention should be directed toward making findings from clinical trials available to practitioners. The authors suggest that those responsible for clinical trials should share responsibility with journal editors and CME planners for disseminating new information.

- 77 Stross, J.K. and W.R. Harlan. (1981, July). Dissemination of Relevant Information on Hypertension. *Journal of the American Medical Association* 246(4), pp. 360–362.

Timely dissemination of new medical information to practicing physicians has been a problem. To examine the magnitude of this problem and useful strategies for correction, a survey of 292 primary care physicians was used to determine their knowledge of the Hypertension Detection and Follow-up Program (HDPF), a clinical trial with important treatment implications, and the Veterans Administration (VA) Cooperative Study. The statistically significant findings reveal that 40 percent (44/110) of the family physicians and 63 percent (114/182) of the internists were aware of the HDPF study within 2 months and 6 months of publication, respectively, while 98 percent (43/44) of family physicians and 97 percent (111/114) of internists were familiar with the results. Eighty percent of the family physicians and 50 percent of the internists listed journals as the source of their knowledge, while 40 percent of the internists learned of it from continuing medical education (CME). Statistically significant differences were also found in the VA Cooperative study where 65

percent (72/110) of the family physicians were aware of the study while 93 percent (168/182) of the internists were familiar with the results. The findings of this study, though limited in size and scope, indicate that rapid dissemination of new information can occur when relevant journals are used and that CME courses also provide a timely and effective means of dissemination.

- 78 Weinberg, A.D., L. Ullian, W.D. Richards, and P. Cooper. (1981, March). Informal Advice- and Information-Seeking Between Physicians. *Journal of Medical Education* 56, pp. 174–180.

The purpose of this study was to establish whether advice- and information-seeking behavior occurs among a county's physicians. In this paper the authors present an assessment of the quantity, quality, and patterns of direct peer communication in a county's physician population. All 79 physicians within a county were mailed a sociometric questionnaire comprised of two questions. The results revealed that colleague interaction occurs on a regular and frequent basis and is of considerable value to the physician seeking advice and information. An analysis of the communication patterns distinguished six physicians as opinion leaders. The findings illustrate the strength of informal communication among physicians and their opinion leaders. This phenomenon may be a key element in facilitating the physician's translation of medical advances into improved patient care with the least delay possible. The authors also suggest that opinion leaders could be involved in roles and approaches at solving inherent problems in continuing medical education, such as serving as gatekeepers for the dissemination of new medical information.

- 79 Williamson, J.W., P.S. German, R. Weiss, and others. (1989, January). Health Science Information Management and Continuing Education of Physicians. *Annals of Internal Medicine* 110(2), pp. 151–160.

A study was conducted to identify self-perceived problems in managing science information needs of U.S. primary practitioners and their opinion leaders. A two-

stage random sample of the American Medical Association's "Masterlist of Physicians" was taken to identify 625 office-based physicians, including general practice, family practice, internal medicine, obstetrics and gynecology, and pediatrics, and 100 physician opinion leaders. A formal telephone survey was completed for 79 percent of practitioners and 90 percent of opinion leaders sampled, using a pretested instrument applied by trained telephone surveyors. The results show that (1) both practitioners and opinion leaders claimed that published reviews were the most useful means of identifying their information needs; (2) less than 1 in 3 practitioners personally searched the literature when information was needed; (3) 2 in 3 claimed literature volume was unmanageable; and (4) 9 of 10 practitioners and opinion leaders assessed the scientific value of literature obtained, with less than 1 in 10 contacting research methods specialists. The authors conclude that primary practitioners require substantial help in meeting current science information needs. An increase in such resources as "validated reviews" or "expert networks" might help meet these needs. Science information management is a critical skill that should be taught in undergraduate medical education.

- 80 Winkler, J.D., K.N. Lohr, and R.H. Brook. (1985, February). Persuasive Communication and Medical Technology Assessment. *Archives of Internal Medicine* 145, pp. 314-317.

Assessments of medical technologies with respect to their efficacy, safety, and cost-effectiveness are expected to influence clinical practice, but they are often lost in an avalanche of medical information. The authors developed a conceptual model to help understand the potential impact on clinical practice of new medical information in general and assessment information in particular. The model identifies aspects of medical communication that may influence an assessment's subsequent impact, including sources, messages, channels, audiences, and settings. They reviewed the literature on how medical information diffuses to physicians and highlighted those factors likely to promote

implementation of recommended changes into practice. The authors suggest that interventions based on formal information dissemination, followed by informal interaction with influential and knowledgeable colleagues (opinion leaders), is likely to have a broad impact on local practices. Implications for educational interventions and promising research directions were also outlined.

- 81 Woolf, S.H. and D.A. Benson. (1989, October). The Medical Information Needs of Internists and Pediatricians at an Academic Medical Center. *Bulletin of the Medical Library Association* 77(4), pp. 372-380.

This article reports the results of a pilot study to document some of the medical information needs of a randomly-selected sample of 67 physicians from the faculty (42) and housestaff (25) at Johns Hopkins Hospital. A standardized questionnaire was administered personally by a medical informatics physician to collect data on information needs, attitudes, and previous computer experience. The types of information most frequently required by both faculty and housestaff were treatment recommendations and differential diagnosis. The reference sources most commonly used were textbooks and colleagues. The information needs of housestaff differed significantly in several categories from those of faculty physicians: housestaff more frequently needed information for patient care and preferred the use of textbooks and handbooks, while faculty more frequently needed information for activities unrelated to patient care and placed greater importance on basic science information. When asked to suggest references for online access, the respondents named 143 journals and textbooks, with journals overwhelmingly preferred over textbooks; only one reference, the *New England Journal of Medicine*, was requested by a majority of the respondents. The importance of understanding physician information needs through improved data-collection techniques is discussed as a means of increasing the effectiveness of medical information systems in improving patient care and outcomes.

- 82 Young, D.A. (1981). Communications linking clinical research and clinical practice. In E.B. Roberts, R.I. Levy, and others (Eds.). *Biomedical Innovation* (pp. 177-199). Cambridge, MA: The MIT Press.

The communication network that carries clinical research to medical practitioners is examined and suggestions for research are drawn from studies of information transfer in basic research, commercial, and industrial settings and from the findings of a study of the dissemination of information from two clinical trials. The randomized, controlled trials include the Veterans Administration's Cooperative Study of Surgery for Coronary Arterial Disease and the National Heart, Lung, and Blood Institute's Cooperative Study of Unstable Angina Pectoris. A total of 106 communications in professional journals

relating to each trial were identified from interviews with clinical trial participants, a computerized data base (MEDLINE), and a manual search of medical and cardiology journals. The author identifies factors influencing the content and readership of the messages in the communication studied. An evaluation of the results from the trials reveals several deficiencies in the communication of research results including (1) scientific deficiencies in the design, analysis, and reporting of clinical research findings; (2) a lack of information that practitioners need to make decisions about individual patient care; (3) a lack of attention to the unique character of clinical trials; and (4) a lack of a systematic way to resolve controversy. Areas for further investigation concern the structure and function of the communication network as well as the research and user linkage.

Behavior Change Methods as Potential Dissemination Mechanisms

General References to Practitioner Behavior Change

- 83 Battista, R.N., J.I. Williams, and L.A. MacFarlane. (1986, March). Determinants of Primary Medical Practice in Adult Cancer Prevention. *Medical Care* 24(3), pp. 216–224.

The authors conducted an in-person survey of a stratified random sample of 430 primary care physicians in the province of Quebec, Canada, to ascertain their patterns of preventive practice with respect to cancer in four anatomic sites: breast, cervix, colon-rectum, and lung. They further explored the data set to elicit the determinants of the patterns of preventive practice. Scales were constructed encompassing practice behaviors for each type of cancer, continuing education intensity, knowledge, and belief, while the content of the scales was delineated through factor analysis and their reliability assessed using Cronbach's alpha. Different patterns emerged for each cancer type. Mode of reimbursement, continuing education, gender of physician, provider-related barriers to prevention, and knowledge were found to be the major predictors of prevention scores for the cancers studied, but their relative importance varied according to each cancer. The importance of understanding the determinants of physician behaviors better is emphasized. Given the importance of knowledge and continuing education of physicians in predicting some of the preventive practices studied in this article, the authors suggest that continuing medical education should be viewed as an effective means of improving performance.

- 84 Dickinson, J.C., G.A. Warshaw, S.H. Gehlbach, and others. (1981, August). Improving Hypertension Control: Impact of Computer Feedback and Physician Education. *Medical Care* 19(8), pp. 843–854.

This controlled trial assessed two physician-directed interventions designed in part to help

physicians deal with "information overload" and computer technology and to improve their skills in managing noncompliant hypertensive patients. The study involved 12,000 patients making 25,000 visits to the medical center during the year and included (1) computer-generated feedback to identify poorly controlled patients and (2) a physician education program on clinical management strategies, emphasizing patient compliance. Four physician practice teams received either computer feedback, the education program, both, or neither. Feedback team physicians received seven monthly listings of the latest visits and blood pressures of their patients. The self-administered learning program included written clinical simulations and didactic material. The findings indicate: (1) all feedback team physicians requested appointments for listed patients, who made twice as many visits as control patients; (2) education team physicians showed significant gains on a content-specific postintervention test; and (3) all patient groups showed improvement in blood pressure. However, no statistically significant differences between intervention teams was detected. The authors suggested that strategies for further improvement in outpatient hypertension management may need to come from outside the traditional medical model.

- 85 Eisenberg, J.M. (1986). Do education and feedback change doctors' decisions? In *Doctors' Decisions and the Cost of Medical Care* (pp. 99–123). Ann Arbor, MI: Health Administration Press Perspectives.

In an attempt to separate more clearly the influence of feedback from that of education on physicians' decisions and practices, this book chapter describes the available literature. Various studies have suggested that the simple transfer of information is sometimes sufficient to alter physicians' practice patterns but is usually not enough. The target of the change effort, the type of education, the characteristics of the recipient, and the way in which the information is delivered are all

critical. When feedback is used to alter physicians' practice patterns, the programs are most likely to be successful if the data are individualized, if doctors are compared with their peers, and if the information is delivered personally by a physician in a position of clinical leadership. As is the case with the use of education to change practice patterns, feedback is most likely to be successful when it addresses a single clinical problem about which physicians have reached consensus regarding standards of practice and for outpatient rather than inpatient services. However, the cost of personalized face-to-face feedback may not generate savings that exceed its cost.

- 86 Eisenberg, J.M. (1986). Other approaches to changing physicians' practices. In *Doctors' Decisions and the Cost of Medical Care: The Reasons for Doctors' Practice Patterns and Ways to Change Them* (pp. 125-142). Ann Arbor, MI: Health Administration Press Perspectives.

The author examines six major ways of altering the practices and medical decisionmaking processes of physicians and describes their complex interaction. Although education and feedback are effective in altering doctors' practices, it is not clear that they are efficient since they can be time consuming and labor intensive and often require more energy, imagination, and leadership than are available. The other approaches used include the participation by doctors in the efforts to change, administrative rules (hospital formularies, drug order forms, peer physician approval of diagnostic tests), financial incentives, and penalties, with any one approach less likely to be successful by itself than when used in combination. Although these other interventions have not been evaluated critically as often as education and feedback, they are increasingly being adopted by hospitals, third-party payers, health maintenance organizations, and employers who are worried about the increasing cost of medical care. Finally, an alternative framework encompassing cognitive, behavioral, and sociological theories of physician decisionmaking is briefly discussed.

- 87 Eisenberg, J.M. and S.V. Williams. (1980). Cost Containment and Changing Physicians' Practice Behavior: Can the Fox Learn to Guard the Chicken Coop? *Journal of the American Medical Association* 246(2), pp. 2195-2201.

A review of the available literature reveals that the important role of physicians in the generation of medical care costs is evident, but methods of inducing physicians to participate in cost-containment efforts are not well developed. It has been estimated that between 50 percent and 80 percent of health care costs are controlled by physicians, though few physicians are aware of the actual cost. Efforts to change physicians' use of medical services have included education, peer review and feedback, administrative changes, participation, penalties, and rewards. This article reviews the experience of these approaches in changing physician behavior. Although educational programs have had mixed success, those using individualized instruction have been most effective. Several feedback and peer-review programs have demonstrated reductions in costs, as have administrative interventions. While penalties and direct rewards may be effective, alterations in the current reimbursement system could offer financial incentives to physicians who practice in a cost-effective manner. None of the methods reviewed has been shown to reduce costs in all situations when used alone, and a number of studies reviewed in this article show changes in behavior when two or more methods are used in conjunction.

- 88 Ford, L., A.D. Kaluzny, and E. Sondik. (1990, August). Diffusion and Adoption of State-of-the-Art Therapy. *Seminars in Oncology* 17(4), pp. 485-494.

This report presents approaches to defining state-of-the-art therapies, provides a theoretical framework for diffusion and adoption, explores the extent to which state-of-the-art cancer therapy is being diffused into practice, and outlines options to facilitate the process. Due to the complexities of cancer therapy and the variables determining patient response, there is a range of treatment options

for specific disease types and stages rather than a single optimal treatment. Approaches used to disseminate state-of-the-art therapy include (1) the Community Clinical Oncology Program (CCOP); (2) the National Cancer Institute's (NCI's) Physician Data Query (PDQ); (3) the National Institutes of Health's (NIH's) consensus development conferences; and (4) the local development of patient management guidelines as illustrated by the NCI-sponsored Community Hospital Oncology Program (CHOP). Diffusion and adoption are affected by three factors: (1) the attributes of the new therapy, program, or technology itself; (2) structural and behavioral characteristics of the adopters; and (3) environmental factors. Recommendations are offered to ensure that state-of-the-art therapy is available to clinicians and their patients. They include tracking, more coordinated efforts among government agencies and other concerned organizations to facilitate diffusion and adoption, and the removal of organizational and financial barriers.

- 89 Freiman, M.P. (1985, August). The Rate of Adoption of New Procedures Among Physicians. *Medical Care* 23(8), pp. 939-945.

The author presents new information on the overall rate of adoption of new procedures by physicians and the determinants of differences in this rate among physicians. A total of 484 physicians was surveyed in order to determine the number of new procedures they adopted during a 1-year period. Clear differences were found among specialties, and a simultaneous statistical analysis of factors affecting the adoption of new procedures yielded a number of additional significant relationships. For all physicians, 37.2 percent reported adopting at least one new procedure, with a low range of 18.2 percent for obstetrics/gynecology and a high of 62.1 percent for radiology. Age has an increasing impact on the number of new procedures adopted by physicians up to an age of approximately 50 years while beyond that age, there is a decreasing effect. Board-certified physicians tend to adopt more new procedures than physicians who are not board certified; among physicians in nonurban locations, those in solo practice adopt significantly fewer procedures than those in

other practice modes. The implications of these findings for such issues as the rising cost of health care and physician reimbursement systems are discussed.

- 90 Geertsma, R., R.C. Parker, and S.K. Whitbourne. (1982, October). How Physicians View The Process of Change in Their Practice Behavior. *Journal of Medical Education* 57, pp. 752-761.

The changes all physicians make in their treatment of patients constitute a key issue in the operation of the health care system. This study identifies a problem-centered model of the change process that reinforces physician self-analysis and facilitates behavior change. Interviews with a random sample of 66 physicians representing five specialties produced data on 182 changes. The fundamental stages of this change process are (1) priming (coming to feel dissatisfaction with some aspect of practice behavior), (2) focusing (learning of alternative practice behavior), and (3) followup (obtaining further information or advice regarding the possible change). Any of a variety of information sources may focus a change, but followup is overwhelmingly dependent on colleague communication (representing local professional opinion) and journals (representing an authoritative professional perspective). This change process model provides a basis for designing continuing medical education activities with the objective being the facilitation and not the direction of such change.

- 91 Goldman, L. (1990, May). Changing Physicians' Behavior: The Pot and the Kettle. *New England Journal of Medicine* 322(21), pp. 1524-1525.

The author briefly reviews and examines several studies on the issue of changing physicians' behavior, especially with regard to test ordering for patients. Theoretically, an effort to change physicians' behavior to reduce unnecessary testing and improve the quality of patient care should employ a combination of approaches including education, feedback, administrative changes, incentives, and penalties. Competing forces such as society's interests, patients' real or

perceived demands, financial incentives, and fears of embarrassment or accusation of malpractice also have a powerful influence, especially when pushing in a consistent direction. The authors' belief is that major, sustainable improvements in test-ordering behavior will require a better definition of the appropriate tradeoffs. If the definition is based on empirical data and results in professional consensus, further research will be required to determine the best methods of changing and monitoring behavior. If the definition of appropriate tradeoffs comes primarily from external cost-containment initiatives, change will probably be effected by administrative strategies, incentives, and penalties.

- 92 Gurwitz, J.H., S.B. Soumerai, and J. Avorn. (1990, May). Improving Medication Prescribing and Utilization in the Nursing Home. *Journal of the American Geriatric Society* 38(5), pp. 542–552.

The authors examined issues surrounding medication use in the nursing home, including the evidence for excessive prescribing, the risks and consequences of adverse drug reactions, and factors contributing to inappropriate prescribing, and they critically review the studies that have investigated approaches for improving drug prescribing and utilization in the nursing home. Interventions in the nursing home have centered primarily around consultant-pharmacist activities, in contrast to the wide range of approaches that have been evaluated and implemented in the hospital setting. Although these activities are now federally mandated in all nursing homes, there is little evidence from adequately controlled studies to document their impact or cost-effectiveness. By contrast, face-to-face educational interventions directed at physicians, called "academic detailing," have been shown to be effective in improving the prescribing behavior of physicians for some medications. The prominent role played by the nursing staff in the utilization of medications in nursing homes suggests that an educational intervention excluding nursing staff would be insufficient to influence drug prescribing and utilization, such as psychoactive drugs and laxatives. Future research efforts must pay greater attention to adequate study design

considerations as well as to the clinical and economic outcomes of such interventions if improvements are to be made.

- 93 Harris, J.S. (1990, December). Why Doctors Do What They Do: Determinants of Physician Behavior. *Journal of Occupational Medicine* 32(12), pp. 1207–1220.

Direct payments to physicians account for about 20 percent of the medical care dollar, but physician decisions directly influence over 80 percent of medical care costs. This article reviews work on physician behavior and notes that physician decisionmaking can be viewed in different ways: (1) as pure information processing; (2) as an interaction with various stimuli, including financial penalties and incentives; and (3) as social behavior, interacting with and reacting to peer and leadership influence. Efforts to change the highly decentralized and nonstandard way that medicine is practiced have had mixed results. According to the author, the model that accounts for the greatest amount of the available data is a multifactorial one that takes all of these views into account. The most successful behavior change efforts use a variety of mutually reinforcing approaches and must be present constantly or else behaviors revert to highly variable (lower-quality) actions and decisions—the less intrusive the strategy, the less effective it is. This suggests that the best practice model to manage costs and quality appears to be one in which physicians and administrators make group decisions, develop and continuously improve agreed upon methods of practice, interact and think before acting, and have rewards for such behavior.

- 94 Kanouse, D.E. and I. Jacoby. (1988). When Does Information Change Practitioners' Behavior? *International Journal of Technology Assessment in Health Care* 4, pp. 27–33.

Programs that disseminate information to health care practitioners do so partly to encourage appropriate changes in practice. Merely providing information, however, is seldom enough to get practitioners to change their behavior. If information transfer

programs are to influence practice, they must be designed to maximize the conditions facilitating change. Reliance on a diffusion model to disseminate information to practitioners has led researchers to over-emphasize the importance of exposure to information and ignore other factors determining whether change occurs, such as practitioners' motivation to change, the context in which clinical decisions are made, and how information is presented. The fact that successful dissemination will not necessarily produce change also has implications for how information transfer programs should be monitored and evaluated. The authors suggest that the design of technology transfer [dissemination] programs should consider (1) the likely effects that information may have on clinical practice, (2) the measurement of change in practitioner behavior as a basic component of evaluation of information transfer, and (3) the use of existing data bases to assess changes in behavior. As expensive technologies proliferate and awareness of health care costs grows, the need for rigorous investigation of programs to inform and influence practitioners becomes more pressing.

- 95 Kanouse, D.E., J. Kallich, and J.P. Kahan. (1991, April). **Dissemination of Practice-Relevant Information to Health Care Providers. Paper presented at the National Agenda Setting Conference in Outcomes and Effectiveness Research.**

This paper focuses on those dissemination processes aimed at reaching an audience of health care providers with practice-relevant information—especially information concerning which practices lead to better outcomes. The authors first discuss what is commonly assumed to happen when information is disseminated to providers and describe recent challenges to that assumption. Previous research suggests that informational interventions delivered through printed material have little or no effect on providers' behavior. Educational interventions or information-dissemination campaigns are more likely to be successful if they incorporate elements associated with successful interventions, such as use of opinion leaders to deliver or endorse a message and provide

followup feedback. A discussion of the literature on the effects of several ways of disseminating practice-relevant information, including consensus development conferences, reports of randomized clinical trials, continuing medical education, and computer-assisted information dissemination is also included. A review of what is known about providers' exposure to and use of various communication channels of information suggests there are lessons to be learned from research on provider behavior and various forms of dissemination (the role of peer influence, physician attitudes, inertial forces working against change). Finally, they consider the wider social scientific literature on expert decisionmaking and social influence with findings applicable to medical dissemination and summarize the implications of current knowledge for future research.

- 96 Lomas, J. and R.B. Haynes. (1988). **A Taxonomy and Critical Review of Tested Strategies for the Application of Clinical Practice Recommendations: From "Official" to "Individual" Clinical Policy. *American Journal of Preventive Medicine* 4(Suppl.), pp. 77–94.**

There are many determinants of clinical action besides research evidence—educational (including continuing medical education [CME]), patient, administrative, and economic influences. A taxonomy of the many strategies designed to improve the translation of evidence-based official policy into individual clinical actions suggests that most have focused on only a few of the potential determinants. This critical review of the most rigorously evaluated strategies suggests that (1) strategies targeting multiple determinants are most likely to be successful; (2) strategies for preventive services should probably be no different than those for other areas of practice; and (3) few strategies have demonstrated a successful impact on patient outcomes, the most promising strategies couple personalized education directed by respected peers with feedback and auditing mechanisms. It is clear that clinicians are neither free from external influences nor very responsive to any particular influence. Because of the complexity of the determinants of clinical policy at the level of the individual

practitioner, simple solutions are unlikely to be forthcoming. This review only deals with physicians, and not other health professionals, patients, and institutions. The authors recommend that (1) future research efforts evaluate incompletely tested strategies in common use; (2) methods to harness automation for quality assurance purposes be explored; (3) new ways to promote development and innovation in dissemination be explored; and (4) those who promulgate practice recommendations should also ensure accurate dissemination and applications of these recommendations.

- 97 Lomas, J., M. Enkin, G.M. Anderson, and others. (1991, May). Opinion Leaders vs. Audit and Feedback to Implement Practice Guidelines: Delivery After Previous Cesarean Section. *Journal of the American Medical Association* 265(17), pp. 2202–2207.

A randomized controlled trial with 76 physicians in 16 community hospitals evaluated an administrative audit and feedback mechanism and local opinion leader education as methods of encouraging compliance with a guideline for the management of women with a previous cesarean section. The guideline recommended clinical actions to increase trial of labor and vaginal birth rates. Charts for all 3,553 cases in the study groups were audited. After 24 months, the trial of labor and vaginal birth rates in the audit and feedback group were no different from those in the control group, but rates were 46 percent and 85 percent higher, respectively, among physicians educated by an opinion leader. Hospital length of stay was lower in the opinion leader education group than in the other two groups, and the overall cesarean section rate was reduced only in the opinion leader education group. Furthermore, there were no adverse clinical outcomes attributable to the interventions, and the use of opinion leaders improved the quality of care. The failure of the audit and feedback mechanism contradicts other research findings. The author speculates that this study's finding may be due to the use of community hospitals (as opposed to teaching hospitals, where motivation to respond to feedback is greater) and to the lack of personalized feedback.

- 98 Schroeder, S.A. (1987). Strategies for Reducing Medical Costs by Changing Physicians' Behavior: Efficacy and Impact on Quality of Care. *International Journal of Technology Assessment in Health Care* 3, pp. 39–50.

The effect of cost-containment measures on the quality of physician health care is examined. The elimination of considerable unnecessary treatment, which has been the rationale for cost-containment will, theoretically, reduce costs without compromising patient welfare. Three main types of evidence for justifying this cost-cutting strategy include variations in practice patterns, the health maintenance organization (HMO) experience, and studies from specific institutions. The author reviews the efficacy of education, feedback, barriers and other administrative mechanisms, and financial incentives as cost containment strategies. They have similar efficacy at the national and institutional levels; however, education and audit seem to be easier to implement, but are less effective than administrative barriers and financial incentives. How cost-containment measures affect the quality of care depends upon their type and efficacy, the prevalence of unnecessary care, the vulnerability of the patients whose clinical services would be reduced, and the type of services withheld.

- 99 Soumerai, S.B., T.J. McLaughlin, and J. Avorn. (1989). Improving Drug Prescribing in Primary Care: A Critical Analysis of the Experimental Literature. *Milbank Quarterly* 67(2), pp. 268–317.

This article reviews studies of nonregulatory measures to improve physician prescribing, such as printed educational materials, government warnings, prescription audits plus feedback, reminders at the time of prescribing, public-interest face-to-face "detailing," and physician counseling. The authors critically review what was known from empirical studies about the effectiveness and efficiency of these approaches to improving prescribing practices in office settings, and they suggest methods for adoption and further research. Their findings include: (1) there is excellent evidence from several well-controlled trials

that using mailed educational materials alone may change knowledge or attitudes, but has little or no detectable effect on actual prescribing behavior although the low cost of this approach may make it worthwhile; (2) well-designed educational materials appear to be an important component of other strategies (for example, face-to-face education or feedback), providing exposure to behavior change messages with subsequent improved practice patterns. The authors concluded that (1) future studies should implement randomized controlled trials or well-designed quasi-experiments; (2) cost/benefit analyses should compare the relative effectiveness of alternative strategies; (3) more emphasis should be placed on intervening in nonacademic office settings where most drug use occurs without benefit of ongoing monitoring and peer review; and (4) effort should be directed to determine the clinical and economic importance of inappropriate prescribing, and the effect of such interventions in reducing drug-induced illness and containing costs.

- 100** Stafford, R.S. (1990, February). *Alternative Strategies for Controlling Rising Cesarean Section Rates. Journal of the American Medical Association* 263(5), pp. 683–687.

The increase in cesarean section rates in the United States from 5.5 percent in 1970 to 24.4 percent in 1987 has generated considerable concern leading to a variety of proposals to control rising use of cesarean section. This study identifies and systematically evaluates the range of strategies proposed and/or adopted to reduce cesarean sections. Six strategies have been adopted or proposed: (1) education and peer evaluation; (2) external review; (3) public dissemination of cesarean section rates; (4) changes in physician payment; (5) changes in hospital payment; and (6) medical malpractice reform. The author reviews the experience with these strategies, noting that they differ in their assumptions regarding the process of clinical decisionmaking, implications for physician autonomy, and methods of implementation. Educational efforts have been the most widely promoted, and of these, formal programs aimed at modifying practice within individual hospitals appear to be the most successful. In

general, successful strategies have been undertaken in practice environments characterized by greater organizational control of decisionmaking in hospitals, health maintenance organizations, and nationalized health systems. Additional study is required on the effectiveness of these strategies by themselves and in combination.

Consensus Development

- 101** Fink, A., J. Kosecoff, M. Chassin, and R. Brook. (1984, September). *Consensus Methods: Characteristics and Guidelines for Use. American Journal of Public Health* 74(9), pp. 979–983.

Formal consensus methods have increasingly become part of the technology for solving problems in medicine and health. Their main purpose is to define levels of agreement on controversial subjects. Advocates suggest that, when properly employed, consensus strategies can create structured environments in which experts are given the best available information, allowing their solutions to problems to be more justifiable and credible than otherwise. This paper surveys the characteristics of several major methods (Delphi, Nominal Group, and models developed by the National Institutes of Health (NIH) and by Glaser) and provides guidelines for those who want to use the techniques. Among the concerns these guidelines address are selecting problems, choosing members of consensus panels, specifying acceptable levels of agreement, properly using empirical data, obtaining professional and political support, and disseminating results.

- 102** Hill, M.N., D.M. Levine, and P.K. Whelton. (1988, September). *Awareness, Use, and Impact of the 1984 Joint National Committee Consensus Report on High Blood Pressure. American Journal of Public Health* 78(9), pp. 1190–1194.

A random sample of 595 Maryland physicians stratified by practice specialty (family, general, internal medicine, cardiology, and nephrology) was surveyed before and 1 year after dissemination of the 1984 Report of the Third Joint National Committee on the Detection, Evaluation, and Treatment of High

Blood Pressure (The JNC III Report). Prior to publication of the report, more than two-thirds of responding physicians were found to be practicing in a manner congruent with 9 of 10 treatment recommendations studied. One year after JNC III Report's release, they reported practice behavior that was not significantly different. The study showed that 1 year after publication, 62 percent (162) of the physicians participating in both parts of the study (262) were aware of the JNC III Report. The guidelines were reported as widely available, and physicians reported familiarity and consistency of practice with them. On the other hand, actual use of the guidelines was low, and less than 20 percent of the physicians reported that they either changed practice or that a great amount of change was needed to adhere to the guidelines. The authors indicated that this consensus report codified, rather than changed, practice behavior in this sample.

- 103 **Jacoby, I. (1985). The Consensus Development Program of the National Institutes of Health: Current Practices and Historical Perspectives. *International Journal of Technology Assessment in Health Care* 1(2), pp. 420-432.**

The evolution of the process of consensus development as a means of technology assessment is traced from its variable and undefined beginnings. The National Institutes of Health created the Office of Medical Applications of Research (OMAR) to improve the translation of biomedical research results into clinical applications and to evaluate these research findings for safety and efficacy. OMAR inaugurated the process of consensus development as a new mechanism for identifying and assessing the safety of medical technologies with identifiable guidelines for selection of consensus conference topics. The study shows that the NIH Consensus Development Program has made great strides toward ensuring that consensus methods produce useful and credible outcomes. It summarizes the four essential elements to this end as the need to (1) carefully select problems amenable to solution by consensus, (2) closely monitor the choice of panels and their leaders, (3) identify justifiable consensus levels, and (4) make sure the findings are

useful and accessible. A total of 40 previous OMAR conferences have been evaluated, analyzed, and utilized to mold a formula that has gained recognition and acceptance. Thus, NIH has demonstrated a unique mechanism for bringing together biomedical scientists, medical practitioners, and the public to deliberately assess complex and often controversial biomedical technologies.

- 104 **Jacoby, I. and M. Rose. (1986). Transfer of Information and Its Impact on Medical Practice: The U.S. Experience. *International Journal of Technology Assessment in Health Care* 2, pp. 107-115.**

This paper focuses on activities of the Office of Medical Applications of Research (OMAR) to disseminate the results of 50 consensus development conferences on the safety and efficacy of important biomedical technologies. The aim of these conferences is to inform the health care community and, to some extent, the public of the status of emerging biomedical technologies and the need for change in the use of existing health-related technologies. OMAR has sought to improve the effectiveness of these transfer activities by conducting assessments of the impact of consensus development conferences on their primary audience, U.S. physicians. OMAR's evaluations of the dissemination practices of other organizations reveal that no single approach to information transfer is appropriate to reach all audiences. Suggested future options for increased effectiveness of information transfer include a newsletter for primary care physicians, free journals, videos for closed-circuit hospital broadcast, television commercials, live transmission of post-conference press briefings with two-way communication, and better use of personal approaches to information transfer.

- 105 **Jacoby, I. and S.M. Clark. (1986, March). Direct Mailing as a Means of Disseminating NIH Consensus Statements: A Comparison With Current Techniques. *Journal of the American Medical Association* 255(10), pp. 1328-1330.**

The Office of Medical Applications of Research of the National Institutes of Health conducted a telephone survey to evaluate the

effectiveness of mass mailing of consensus statements compared with traditional dissemination methods, and selected the consensus statement on osteoporosis for study. A total of 695 telephone interviews were completed (65 percent response rate) from a sample of at least 200 randomly selected physicians from two comparable city regions (St. Louis, experimental; Cleveland, control). The findings reveal a statistically significant difference between the two groups, with the experimental group (40 percent) exhibiting a much higher overall awareness of the osteoporosis conference than did the control group (27 percent). In the two most extreme examples, internal medicine and geriatrics, the experimental group's greater awareness was 45 percent versus 22 percent and 56 percent versus 28 percent, respectively, while statistically significant differences were not detected in other specialties. The principal factor to which the significantly higher overall awareness in the experimental specialty group can be attributed to is the mass mailing of osteoporosis consensus statements shortly after publication in the *Journal of the American Medical Association* and just prior to conducting the survey. The findings suggest that while a small but significant increase of awareness resulted from direct mailing, this increase should be weighed against costs and effectiveness of other methods.

- 106 Kahan, J.P., D.E. Kanouse, and J.D. Winkler. (1988). Stylistic Variations in National Institutes of Health Consensus Statements, 1979–1983. *International Journal of Technology Assessment in Health Care* 4, pp. 289–304.

A content analysis of the structure of communication embodied in a set of statements of 24 consensus development conferences was conducted by the Office of Medical Applications of Research of the National Institutes of Health, in the years 1979–83. The goal was to understand the potential influence of the consensus statements by identifying characteristics that might determine whether and how physicians became aware of their findings and adopt their recommendations. Three characteristics emerged, each suggestive of a different style of consensus statement: discursiveness,

didacticism, and scholarliness. Variations in style among consensus statements may affect their acceptance by the medical profession. The authors speculate that factors associated with a greater degree of acceptance of consensus statements might be (1) less discursiveness (that is, more recommendations and other scientific material); (2) greater didacticism (since consensus statements focus on providing guidance to clinicians); and (3) less scholarliness (that is, more directly accessible and relevant to practitioner needs).

- 107 Kaluzny, A.D. (1990). Dissemination and impact of consensus development statements. In *Improving Consensus Development for Health Technology Assessment: An International Perspective*. Washington, DC: Council on Health Care Technology, Institute of Medicine, pp. 69–83.

The National Institutes of Health initiated consensus development conferences in 1977 to develop a statement of accepted standards for clinical practice, either with regard to the use of a particular technology or the treatment of a particular disease or syndrome. This article provides a comparative review of the main elements of dissemination activities of consensus development conferences in various countries to analyze international efforts in the dissemination of consensus recommendations, to consider different methods of diffusion, and to assess their impact. Based on program profiles prepared by each country for the International Workshop on Consensus Development for Medical Technology Assessment (1989), the author analyzes evidence concerning four factors that directly influence dissemination activities: (1) attributes of the technology under review and the resulting consensus statement, (2) the behavior and structure of adopter characteristics, (3) the environmental constraints and incentives in which dissemination occurs, and (4) the communication channels used to learn about new medical technologies. Suggested possible areas for future research include evaluation of specific dissemination methods; assessment of the role of organizational intermediaries; interaction of attributes, adopters, and environmental characteristics; dissemination

and changes in actual clinical practice; and revising assumptions about the role of dissemination.

- 108 Kanouse, D.E., J.D. Winkler, J. Kosecoff, and others. (1989). *Changing Medical Practice Through Technology Assessment: An Evaluation of the NIH Consensus Development Program*. Ann Arbor, MI: Association for Health Services Research and Health Administration Press.

The Consensus Development Program (CDP) of the National Institutes of Health was established to assess the safety and efficacy of medical technologies by evaluating scientific information about biomedical technologies and producing and disseminating consensus statements for health care providers, the public, and the scientific community. The consensus development method blends elements from three models: (1) the process of judicial review, (2) the scientific meeting, and (3) the town meeting. This comprehensive evaluation examines the effects that the CDP has had on physicians' knowledge, attitudes, and practices, and it assesses how well the program met its communication objectives. The authors make practical recommendations for how its effectiveness might be increased. The evaluation is based on (1) a content analysis of published statements; (2) analyses of the professional and popular literature; (3) a national survey of 1,453 physicians from a variety of specialties on several topics, including their information habits and attitudes towards the CDP; (4) a medical record review and hospital survey conducted in 10 acute-care hospitals in Washington State; and (5) a survey of 469 physicians whose patients' medical records were abstracted. Content analysis was conducted on 24 consensus statements issued between 1979 and 1983 and 8 conferences held in 1979 and 1980, with a resulting description of the main findings. A discussion of suggestions to improve the effectiveness program is based on its four major components: (1) selection of topics, (2) organization, (3) dissemination of findings, and (4) monitoring effects.

- 109 Kosecoff, J., D.E. Kanouse, and R.H. Brook. (1990, December). *Changing Practice Patterns in the Management of Primary Breast Cancer: Consensus Development Program*. *HSR: Health Services Research* 25(5), pp. 809-823.

In 1979, the National Institutes of Health held a consensus conference on the treatment of primary breast cancer in light of the new knowledge gained concerning the efficacy of treatment. To determine whether the consensus conference had influenced practice patterns, and to evaluate the level of quality of care given to women with breast cancer, the medical records of 573 patients treated in 10 hospitals throughout the State of Washington were abstracted and analyzed. The results showed no changes with respect to the consensus conference's recommendations for use of a total mastectomy with axillary dissection in women with Stage I or early Stage II breast cancer or the use of a two-step procedure in which the biopsy is performed first and therapeutic options are discussed before a definitive surgery is undertaken. Analyses of quality care issues not addressed by the consensus conference revealed that 4 percent of the sample were explicitly staged preoperatively and 29 percent postoperatively and that little changed over time in the use of sentinel laboratory tests. These results show that consensus recommendations will not necessarily change physicians' behavior even where change is possible, and that quality of care in diagnosis and treatment of breast cancer still needs to be addressed.

- 110 Kosecoff, J., D.E. Kanouse, and others. (1987, November). *Effects of the National Institutes of Health Consensus Development Program on Physician Practice*. *Journal of the American Medical Association* 258(19), pp. 2708-2713.

The effects of the Consensus Development Program of the National Institutes of Health on physician behavior were investigated. The medical records of 2,770 patients treated in 10 hospitals throughout the State of Washington

were reviewed to determine if quality of care improved with respect to 12 recommendations put forth by 4 consensus panels concerning surgical management of primary breast cancer, the use of steroid receptors in breast cancer, cesarean childbirth, and coronary artery bypass surgery. Care was studied during 24 months before and 13–24 months after each consensus conference. Results showed that the conferences mostly failed to stimulate change in physician practice, despite moderate success in reaching the appropriate target audience. According to the authors, one possible explanation of these findings might be that the “after” time period occurred too soon for changes to have taken place, although no additional evidence to refute this assertion was presented. It was concluded that the consensus development conference is an important tool whose effects might be enhanced by focusing on areas of practice that need improvement and by encouraging followup programs at the State and local level and at the level of the individual to help translate the message into action with monitoring to determine that change is occurring.

- 111 Lomas, J. (1991). Words Without Action? The Production, Dissemination, and Impact of Consensus Recommendations. *Annual Review of Public Health* 12, pp. 41–65.

The author presents some of the methods for consensus production and a set of standards by which to judge the validity of the various approaches. A review of the dissemination and impact of consensus recommendations of the methods of dissemination, and of an appraisal of the 19 studies identified in the literature that evaluate the impact of dissemination on behavior reveals promise for the impact of consensus on cognitive, rather than behavioral, outcomes and the potential for combining the output of consensus with more active strategies for implementing changes in clinical practice. In particular, consensus recommendations can predispose physicians toward change, with actual behavior change strategies being implemented at the local level. Consensus recommendations should be produced with care and attention to validity because (1) recommendations do

sometimes affect clinician behavior as a consequence of simple dissemination and (2) the output from consensus processes is increasingly a potential input to other processes—consensus recommendations can be used as the criteria for evaluation and appraisal aimed at changing practice behavior, making administrative decisions on resource allocation, or defining research protocols.

- 112 Lomas, J., G. Anderson, M. Enkin, and others. (1988, May). The Role of Evidence in the Consensus Process: Results from a Canadian Consensus Exercise. *Journal of the American Medical Association* 259(20), pp. 3001–3005.

This study evaluates the role of research evidence in the group process leading to consensus development. As part of a Canadian consensus conference on cesarean birth, the 10-member consensus panel rated 224 clinical scenarios on their appropriateness for a cesarean section—there were 144 scenarios on previous cesarean section, 48 on breech presentation, and 32 on dystocia. Ratings were obtained before and after the conference. The level of consensus among panelists was assessed separately for “evidence scenarios,” with good research evidence and for “nonevidence scenarios,” with conflicting, poor, or no evidence. For each scenario, consensus between panelists was measured as total agreement, partial agreement, or disagreement on the appropriateness of a cesarean section. Before the conference, total or partial agreement existed for a larger percentage of evidence than nonevidence scenarios (85 versus 30 percent), with the pattern reversed for disagreements (15 versus 70 percent). After the conference, improvement in the level of consensus actually occurred for 71 percent of the evidence and only 24 percent of the nonevidence scenarios. Thus, the consensus process was sensitive to the availability of good evidence and suggests that aspects of both expert and public processes can successfully be combined. However, the study shows that an improvement could be made in the process by grading final recommendations according to the availability of rigorous research evidence.

- 113 Winkler, J.D., D.E. Kanouse, L. Brodsley, and R.H. Brook. (1986, March). Popular Press Coverage of Eight National Institutes of Health Consensus Development Topics. *Journal of the American Medical Association* 255(10), pp. 1323–1327.

As part of a larger evaluation study, the authors analyzed popular press coverage of eight topics selected by the National Institutes of Health for consensus development conferences in 1979 and 1980. Using periodical indexes to identify relevant articles, they examined the characteristics of 269 topical articles published in newspapers and magazines in the 4 years surrounding each conference and examined the role that the consensus development conference played in subsequent reporting. Most topics received widespread press interest that culminated around the time of each conference. Consensus findings were widely cited in articles that appeared after the conferences. A comparison of the content of articles written before and after the conferences showed post-conference articles to be more factual and less oriented to advocacy. Articles were mostly factual and balanced and relied on experts, and they emphasized major themes covered by the conference. The authors conclude that the popular press can make an important contribution to the dissemination of new medical information.

- 114 Wortman, P.M., A. Vinokur, and L. Sechrest. (1988, Fall). Do Consensus Conferences Work? A Process Evaluation of the NIH Consensus Development Program. *Journal of Health Politics, Policy and Law* 13(3), pp. 469–498.

The purpose of this evaluation study is to identify problems and suggest modifications in the National Institutes of Health's Consensus Development Program. Eight consensus conferences held between 1980 and 1982 were studied in depth using a variety of methods. Five conferences were investigated concurrently; in addition, archival material was examined for all but 1 of the 33 conferences held up to that time, and 4 planning meetings for future conferences were observed. The delay in publishing the findings provided an opportunity to examine changes

introduced by NIH, and avoided the criticism of prior evaluations that found fault with programs that were still developing. NIH adopted many of the recommendations in this evaluation and more recent evidence; however, the authors conclude that the major problem uncovered—selection bias, particularly with respect to the choice of questions and panelists—remains a significant threat to the credibility of the consensus process. More specifically, the results indicate that controversial issues cannot be properly addressed within the NIH format, although that was one of its major purposes. Recommendations for improving the consensus process are presented, as are the implications for other consensus activities.

Continuing Medical Education

- 115 Beaudry, J.S. (1989). The Effectiveness of Continuing Medical Education: A Quantitative Synthesis. *Journal of Continuing Education in the Health Professions* 9(4), pp. 285–307.

This is a meta-analysis of continuing medical education (CME), limited to studies with control groups that were examined according to method of selection and type of control. A total of 41 studies (from over 300), based on a total of 1,940 physicians and including research on 14,750 patients, were read and coded according to information considering validity and reliability issues. Information included (1) background characteristics (for example, publication year, author credentials); (2) characteristics of the educational treatment (for example, content of program, time on task, length of program, level of participation and other instructional variables, voluntary versus mandatory attendance); (3) comparability of experimental and control groups; (4) evaluation outcome measured; (5) research design and threats to validity; and (6) reported statistics. Instructional factors or “alterable variables” in the teaching-learning process were examined, such as quantity of instruction, factors relating to the learning context or environment, program planning, and “qualities of instruction” (feedback mechanisms, individualization of instruction, and reinforcement of behavior). Data are presented and analyzed for each of these

factors. The major finding was that CME showed positive effects for all measured outcomes—physician knowledge, physician performance, and patient health status, with other interactions noted among the variables of needs assessment, followup measures, and use of feedback. There are “returns” on investment (in direct CME program costs) in physician knowledge, physician performance, and patient health status.

- 116 Davis, D., R.B. Haynes, L. Chambers, and others. (1984, September). The Impact of CME: A Methodological Review of the Continuing Medical Education Literature. *Evaluation and the Health Professions* 7(3), pp. 251–283.

A review of the literature evaluating the effectiveness of continuing medical education (CME) was undertaken using articles from 1935 to 1982. A total of 238 studies was reviewed and annotated using previously established criteria. They included the study design, the educational or administrative intervention, the evaluation maneuver used to assess the intervention’s outcome, the health professionals used as subjects, and the educational and statistical significance of the study. Studies were further classified into one of four design groups: 170 (71 percent) in the descriptive (DES) or before/after approach group, 24 (10 percent) in the randomized control trial group (RCT), 8 (3 percent) in the nonrandom control trial (CT), and 36 (15 percent) in the cohort-analytic or case control group. The assessment of the 238 articles revealed that 98 studies (41 percent) reported the perception of CME participants, 86 (36 percent) evaluated change in competency (knowledge, skills, and attitudes), 128 (54 percent) dealt with physician performance or behavioral change, and 30 (13 percent) measured patient or health care outcomes. It would appear that CME interventions when broadly defined have an impact on physician competence and, less consistently, on physician performance and patient outcomes. The authors conclude that further research in both the methods and evaluation of CME is necessary.

- 117 Evans, C.E., R.B. Haynes, N.J. Birkett, and others. Does a Mailed Continuing Education Program Improve Physician Performance? Results of a Randomized Trial in Antihypertensive Care. *Journal of the American Medical Association* 255(4), pp. 501–504.

The authors studied the value of educational materials in a mailed continuing education program on hypertension for primary care physicians. The study had two parts: (1) a population blood pressure survey—interviews in 5,567 households with 198 of 6,705 adults and (2) a randomized trial, where 41 physicians in 33 practices (named as the source of patients’ primary and/or hypertensive care) were randomly allocated to the study group. Pretesting documented that the materials were read and led to significant improvements in physician knowledge over the short term. However, the current study showed no lasting effect on physician knowledge (mean end-of-study scores were 50 percent and 52 percent for study and control physicians) and no influence on the blood pressure of patients referred from screening (mean blood pressure drop for study patients was 12.2/10.4 mm Hg versus 13.0/10.6 mm Hg for control patients). There was less than a 5 percent chance that the study missed a difference in diastolic blood pressure as great as 3 mm Hg, and hence, resources on instructional materials mailed to physicians may be wasted. Possible explanations to these findings include (1) the program may have been ineffectual in transmitting knowledge; (2) the program information was forgotten; and (3) the program had no effect because both groups performed as well as current medications and methods of achieving high patient compliance permit.

- 118 Geyman, J.P. and M.J. Gordon. (1982). Learning Outcomes and Practice Changes After a Postgraduate Course in Office Orthopedics. *Journal of Family Practice* 15(1), pp. 131–136.

This paper presents the results of a study of immediate and delayed learning outcomes,

including a parallel exploration of physician intentions and practice changes, among 83 primary care physicians attending a 5-day continuing medical education (CME) course in office orthopedics. Changes in practice behavior for three specific tracer procedures (torsional profiles, corrective shoes, arthrogram of shoulder), were surveyed on three testing occasions (precourse, postcourse, and 6-month followup). A statistically significant level of knowledge gain and retention was found between those receiving "academic" and "pragmatic" instructions for clinical situations in precourse and followup test administrations, with some erosion of those gains later, though not to pretest levels. Change in practice behavior occurred in self-reported use of torsional profiles, ordering of shoulder arthrograms, and the discontinued use of corrective shoes. Discrepancies between physicians' cognitive knowledge, their intentions to apply that knowledge, and reported clinical behavior were consistent with a conservative approach to orthopedic management among the primary care physicians studied. The authors suggest that more research on the epidemiology and natural history of common diseases in the general population entering the primary care setting is needed to determine why practice behaviors do not change in response to newly acquired medical knowledge.

- 119 Haynes, R.B., D.A. Davis, A. McKibbon, and P. Tugwell. (1984, January). A Critical Appraisal of the Efficacy of Continuing Medical Education. *Journal of the American Medical Association* 251(1), pp. 61-64.

To determine the efficacy of continuing medical education (CME) on the performance of private physicians in practice and on patient outcomes, 248 articles describing studies of CME interventions that contained sufficient original data for methodological analysis were collected. Articles were abstracted according to predetermined and pretested methodological standards and then selected when they reported studies meeting a second set of criteria (including design, interventions, subjects, and outcomes). Seven articles met all of the criteria and were

reviewed in detail. In all, 28 different clinical topics were included in the content of the CME interventions studied. The findings revealed that 38 percent of the studies included assessments of clinical performance, and 13 percent of the studies employed a randomized trial design, but only 7 percent of all articles and 20 percent of randomized trials assessed the impact of CME on patient outcomes. These studies provide convincing evidence that CME can improve physician behaviors; however, only three of the methodologically sound studies assessed patient outcomes and only one demonstrated any improvement in outcomes.

- 120 Lloyd, J.S. and S. Abrahamson. (1979, September). Effectiveness of Continuing Medical Education: A Review of the Evidence. *Evaluation and the Health Professions* 2(3), pp. 251-280.

In this review article, evidence regarding the effectiveness of continuing medical education (CME) is reviewed in terms of three possible end-products: physician competence, physician performance, and patient health status. Results of this review are presented in the context of recent increases in mandatory CME policies and the corresponding cost of such policies to the Nation. The number of CME activities is on the increase; however, according to conventional wisdom, CME is not effective. To the contrary, 22 of 47 evaluation studies published since 1960 reported demonstrable improvement in at least one of the three end-products following CME. In 10 of the 22 evaluation studies, the results show that the difference observed—either between before-and-after measures or between experimental and control groups—was statistically significant in the direction of improved physician competence while over half (of 22) report an improvement in physician competence following CME. However, methodological shortcomings in many of these studies make it impossible to conclude that the improvements were caused by the CME, and the authors discuss the need for more research surrounding the subject of CME and its effectiveness.

- 121 Manning, P.R., P.V. Lee, W.A. Clintworth, and others. (1986, July). Changing Prescribing Practices Through Individual Continuing Education. *Journal of the American Medical Association* 256(2), pp. 230–232.

In a study of prescribing behavior involving 94 practicing physicians, committees of clinical pharmacologists analyzed copies of prescriptions and additional relevant data to identify problems in prescribing. Only the 10 most commonly prescribed drugs were studied in the samples of 200 prescriptions from each physician. From a total of 8,320 prescriptions, the faculty committee identified 1,061 prescribing problems, amounting to 12.8 problems per 100 prescriptions. One group of 41 physicians (the study group) received feedback in the form of instructional packets that addressed specific problems in prescribing; a second sample consisting of 200 prescriptions was then collected and analyzed. The physicians in this group changed their prescribing practices 30 percent of the time in accordance with recommendations, whereas those in the group that received no educational feedback changed in only 3 percent of the cases. When a physician stated an intention to change, an actual change resulted 50 percent of the time. The authors concluded that individualized teaching in response to real events in practice is a practical and effective method of improving physician performance. The strengths of the method used in this study lie in its practical and nonintrusive technique, and its focus on addressing specific problems.

- 122 Mazmanian, P.E., R.B. Williams, C.E. Desch, and R.E. Johnson. (1990). Theory and Research for the Development of Continuing Education in the Health Professions. *Journal of Continuing Education in the Health Professions* 10, pp. 349–365.

In the continuing education of health professionals, there has been a long-standing interest in evaluating the knowledge, skills, and attitudes changed through participation in continuing medical education programs. Some researchers have attempted to link the relative value of a continuing education program for

health professionals (CEHP) to how well a participant's patients improved after the learner completed a selected CEHP program. This article reviews cases on how continuing education practitioners can benefit from the use of theory and research from work of the Society of Medical College Directors of Continuing Medical Education (SMCDCME), and on how theory testing, programming, and scientific research occur in a conjoint fashion as shown in the HealthTouch Project. The SMCDCME change project and the HealthTouch project provide examples of how theory may be utilized; results offer academic and practical insights, and the process offers new-found control over the politically influenced research questions. The authors conclude that (1) for both the SMCDCME and Healthtouch projects, CEHP planners function as agents of change, spurring the projects along and linking resources together to define and solve problems associated with education and health care and (2) as practitioners become increasingly involved in research, the lines between research and practice may be expected to blur.

- 123 Pinkerton, R.E., N. Tinanoff, J.L. Willms, and J.T. Tapp. (1980, November). Resident Physician Performance in a Continuing Education Format: Does Newly Acquired Knowledge Improve Patient Care? *Journal of the American Medical Association* 244(19), pp. 2183–2185.

As part of an educational program in preventive dentistry for family medicine residents, the authors evaluated changes in systemic fluoride prescribing habits related to newly acquired knowledge. Residents, unaware of the study, were randomly assigned to one of two groups and shown a video tape describing preventive dental techniques; the tape viewed by one group was supplemented with specific instructions explaining the implementation of the information in patient care. Residents in both groups demonstrated the ability to learn and maintain their level of knowledge during a 3-month period. Daily chart audits, however, revealed no substantial increase in correct prescribing of systemic fluoride to pediatric patients for either group, and only subsequent individual monitoring and reinforcement achieved the desired

behavior. The acquisition of new knowledge by resident physicians under these circumstances did not lead to its application in daily patient care. This result parallels reported difficulties in altering physician behavior through continuing medical education programs, and suggests that residency programs are appropriate vehicles to initiate improved physician performance in response to acquired knowledge.

- 124 Sibley, J.C., D.L. Sackett, V. Neufeld, and others. (1982, March). A Randomized Trial of Continuing Medical Education. *New England Journal of Medicine* 306(9), pp. 511-515.

To determine whether continuing medical education (CME) affects the quality of clinical care, 16 Ontario family physicians were randomly allocated to 2 groups of 8 each to receive (study group) or not receive (control group) continuing education packages covering clinical problems commonly confronted in general practice. Over 4,500 episodes of care, provided before and after the program of continuing education, were compared with preset clinical criteria and classified according to quality. Although objective tests confirmed that the study physicians learned from the packages, there was little effect on the overall quality of care. When the topics were of relatively great interest to the physicians, the control group showed as much improvement as did the study group (6 percent increase for both groups); however, when the topics were not preferred, the documented quality of care by study physicians rose by 10 percent, a significant difference from that of control physicians (decreased by 1 percent). There was no spillover effect on clinical problems not directly covered by the program. The authors conclude that in view of the trend toward mandatory continuing education and the resources expended, it is time to reconsider whether CME works—additional randomized trials of whether continuing education actually changes clinical behavior ought to be conducted to refute, confirm, or expand these results.

- 125 Stross, J.K. and G.G. Bole. (1980, July). Evaluation of a Continuing Education Program in Rheumatoid Arthritis. *Arthritis and Rheumatism* 23(7), pp. 846-849.

A continuing medical education (CME) program in rheumatoid arthritis was implemented and evaluated in six community hospitals randomly assigned to control or intervention groups. The program was targeted at primary care physicians and focused on physicians identified by their peers as being educationally influential for the dissemination of content knowledge. Although inpatient and outpatient audits of physician records demonstrated little change in three control communities, substantial improvement in the utilization of diagnostic procedures and patient management was documented in the three intervention communities utilizing the influential physicians. The data revealed that in the preintervention period 52 patients were discharged from the 6 hospitals with a primary diagnosis of rheumatoid arthritis (34 in control, 18 in experimental), while 62 patients were discharged during the intervention period (33 in control, 29 in experimental); gender and age were similar during both data collection periods. The authors concluded that CME delivered through community-based educationally influential physicians (opinion leaders) is an effective way to change physician behavior in small communities with no prior ongoing educational programs. Furthermore, this approach should improve the primary care given to patients with rheumatoid arthritis and reduce the need for participation of academic faculty in traditional CME programs.

- 126 Stross, J.K. and W.R. Harlan. (1978, June). The Impact of Mandatory Continuing Medical Education. *Journal of the American Medical Association* 239(25), pp. 2663-2666.

In 1975 the State of Michigan became the first large State to legally mandate physician participation in continuing medical education (CME) as a prerequisite for annual reregistration of their license to practice medicine. A survey was conducted in 1977 to

examine the continuing education and attitudes of physicians and compared with a similar survey in 1970. Of 505 respondents, CME was required of 78 percent (394) for relicensure; 39 percent of them (155/394) reported that the law had increased their participation in CME. More than 75 percent of the physicians (378/497) believed mandatory CME was worthwhile, and 69 percent (344/497) believed that State licensing authorities should be responsible for guaranteeing that licensed physicians are competent; 35 percent (173) believed that formal testing should determine competence. The survey also obtained ranking of the educational value of different sources. Age was the important factor rather than specialty with respect to competency testing, with younger physicians in all specialties in favor of formal testing, and the older group strongly opposed to it. The authors found the results not remarkably different from the 1970 survey, even though the previous sample was from the general physician population and not from CME attendees. Continuing education habits and attitudes did not appear to have been altered by the new law, despite widespread endorsement of mandatory CME; however, it did appear to stimulate hospitals to offer CME courses.

- 127 Stross, J.K., R.G. Hiss, C.M. Watts, and others. (1983). Continuing Education in Pulmonary Disease for Primary-Care Physicians. *American Review of Respiratory Disease* 127, pp. 739–746.

This article reviews a continuing medical education program that was implemented and evaluated in 16 community hospitals, targeted at over 300 primary-care physicians, and used physicians identified by their peers (using a questionnaire containing 26 descriptors from four characteristics of influential physicians: communication, function, performance, and personal attributes) as educational influentials (opinion leaders) in the dissemination of information. Self-study materials were used, followed by an intensive 2-week preceptorship resulting in a significant increase in physician knowledge. Inpatient charts identified a series of changes in the management of chronic obstructive pulmonary disease in the intervention hospitals that were not noted in

the control hospitals. These included the increased use of intravenously administered fluids, loading doses of intravenously administered bronchodilators, aerosolized and single agent bronchodilators, and respiratory therapy services. The authors conclude that continuing medical education, delivered through community-based educational influentials, is an effective way of changing physician behavior in small communities without ongoing educational programs. This approach should improve patient care and may reduce the need for academic faculty in traditional continuing education programs.

- 128 Wergin, J.F., P.E. Mazmanian, W.W. Miller, and others. (1988). CME and Change in Practice; An Alternative Perspective. *Journal of Continuing Education in the Health Professions* 8(3), pp. 147–159.

This 2-year study by the American College of Cardiology (ACC) assessed the effects of its continuing medical education programs on physician behavior. The principal method of evaluation was a telephone interview conducted by six fellow cardiologists. Participants were interviewed (63 study participants from 24 States and a province in Canada the first year and 74 study participants from 26 States and a Canadian province the second year) before and after the CME conferences; control groups were drawn from program cancellations and/or attendees at contiguous courses and data abstracted from patient charts were also collected from a subsample of participants. Specific course-related behavior change ranged from 53 to 74 percent of participants, and 7 to 29 percent of controls. Results revealed that (1) the CME courses contained relatively little information new to the audience and (2) other influences on practice interacted with CME content—change attributable to CME was generally subtle and often delayed. The data did suggest that CME courses do significantly affect physician behavior when behavior change is defined to include adjustments and refinement to patient care, not just wholesale changes. Theoretical implications for physician behavior change and CME programming are discussed.

- 129 Wolf, F.M., L.D. Gruppen, C. Van Voorhees, and J.K. Stross. (1986, September). Dimensions of Motivation for Continuing Medical Education of Primary Care Physicians. *Evaluation & the Health Professions* 9(3), pp. 305–316.

This study examines the reasons and underlying dimensions of the motivations of primary care physicians for participating in continuing medical education (CME). Physicians rated the importance of 18 reasons for participating in CME on a Motivation for Continuing Medical Education (MCME) inventory. Results indicated that the most important reasons were maintaining competence, increasing knowledge and skills, staying up to date, and enhancing patient care. The least important reasons were financial gain and improving professional image and work situation. Comparisons of physicians' reasons for CME with the desires of the public and legislative bodies revealed both similarities and differences. A principal components analysis of the MCME items yielded six relatively independent underlying motivational dimensions accounting for 71 percent of the total variance: Competence and Patient Care, Collegial Interaction, Professional Enhancement, Efficiency, Respite from Practice, and Legal Concerns. It is suggested that these motivational dimensions may be helpful in the planning of continuing medical education programs.

Feedback

- 130 Berwick, D.M. and K.L. Coltin. (1986, March). Feedback Reduces Test Use in a Health Maintenance Organization. *Journal of the American Medical Association* 255(11), pp. 1450–1454.

In a cross-over design, three interventions were tested for their impact on the use of 12 commonly ordered blood tests and roentgenograms among 35 internists in a health maintenance organization. Overall use fell by 14.2 percent in a 16-week period (study year consisted of 3 consecutive 16-week periods) during which physicians received confidential feedback on their individual rates of use compared with peers (cost feedback), including a decrease in

11 of 12 tests. Similar feedback on rates of abnormal test results (yield feedback) and a program of test-specific education failed to show a consistent effect. Variability in rates of test use among physicians, as measured by the coefficient of variation, fell by 8.3 percent with cost feedback, by 1.3 percent with yield feedback, and by 2.3 percent with education, but these changes were inconsistent across tests. On the other hand, for the average test, the coefficient of variation increased by 13.5 percent between control periods. The authors conclude that it is unknown whether sustained feedback would produce sustained behavior change or whether behavior would regress toward preintervention levels. Peer comparison feedback on rates and cost of test use holds promise for reducing absolute rates of testing and variation among physicians within groups.

- 131 Cohen, D.I., P. Jones, B. Littenberg, and D. Neuhauser. (1982, March). Does Cost Information Availability Reduce Physician Test Usage? A Randomized Clinical Trial with Unexpected Findings. *Medical Care* 20(3), pp. 286–292.

It is believed that physicians control 80 percent of the costs of medical care. The authors hypothesized that providing feedback about the costs of their testing would lead to a reduction in test usage but that this reduction would diminish when the feedback ceased. Four similar teams or "firms" of physicians (at Cleveland Metropolitan General Hospital) associated with similar inpatient units and randomly assigned 511 patients were used to study the effect of providing physicians with cost information about their use of lab tests and X-rays over a 4-week interval. Two teams received information about lab test costs, and two received X-ray test costs. Results revealed that test usage fell during the experimental conditions and continued to fall after the experimental period ended in teams in which there was an interested leader. The sharpest drop in laboratory test usage occurred in the followup period in the two X-ray firms that did not receive feedback. The authors concluded that the results were not consistent with their initial hypothesis and that simple cost feedback mechanisms will not by themselves ensure reduction in test usage—

it requires preparing physicians to use these data.

- 132 Cummings, K.M., K.B. Frisof, M.J. Long, and G. Hryniewicz. (1982, March). The Effects of Price Information on Physicians' Test-Ordering Behavior. *Medical Care* 20(3), pp. 293–301.

This research evaluates the effects of providing physicians with information about the prices of diagnostic tests on subsequent test-ordering behavior. The study population consisted of 36 second- and third-year residents and 23 clinical faculty in three family practice centers affiliated with the Department of Family Medicine at Wayne State University in Detroit, Michigan. Study participants were asked to review four case studies, each describing a patient with ambiguous symptoms, and to indicate the tests they would order. Subjects were randomly assigned either to a group that received test order forms with prices of tests (price-information group) or to a group that received test order forms with no prices (control group). The results show that for each of the four cases, the average number of diagnostic tests ordered was significantly lower in the price-information group (30.8 percent) than in the control group, and showed an average reduction of 31.1 percent in the cumulative cost of tests ordered per patient. This suggests that providing physicians with information about the prices of diagnostic tests (before tests are ordered) is an effective strategy for reducing the number of tests ordered, although this approach does not deal directly with the problem of the inappropriate test ordering. The authors review the feasibility of regularly providing physicians with price information in light of other approaches to modify physician behavior in ordering diagnostic tests.

- 133 Eagle, K.A., A.G. Mulley, S.J. Skates, and others. (1990, August). Length of Stay in the Intensive Care Units: Effects of Practice Guidelines and Feedback. *Journal of the American Medical Association* 264(8), pp. 992–997.

Consensus management guidelines were developed for patients admitted with chest pain, pulmonary edema, and syncope and

were used to examine practice variations and the effects of physician feedback on decision making in 987 admissions to 3 medical intensive care units (ICUs). Data collection included a 6-month baseline period and two 6-month physician feedback periods. The results show that hospital length of stay fell from 8.34 days to 7.41 and 7.14 days during feedback, while ICU length of stay fell from 2.45 days to 2.34 and 2.07 days. Feedback was associated with an increase in the percentage of patients conforming to the management guidelines, especially among patients not requiring a major intervention but with a major illness. Multiple linear regression showed that feedback correlated with reduction of 0.79 days in hospital length of stay and 0.21 days in ICU length of stay. During the 6-month followup, mortality, readmission, and urgent readmission rates were similar for patients admitted in baseline and feedback periods. The authors conclude that the application of guidelines in a physician-feedback intervention was both acceptable and effective in reducing ICU and hospital utilization, and if validated in other centers, such an intervention could result in an overall reduction in ICU utilization of nearly 10 percent.

- 134 Gehlbach, S.H., W.E. Wilkinson, W.E. Hammond, and others. (1984, March). Improving Drug Prescribing in a Primary Care Practice. *Medical Care* 22(3), pp. 193–201.

The study evaluated a model for improving physician prescribing that uses computerized feedback in a family medicine residency practice. Resident and faculty physicians were stratified by level of experience and randomized into two groups—experimental and control—with 22 physicians per group. Following a 4-month baseline period in which the prescribing behavior of all physicians was monitored, the experimental group received monthly printouts for 9 months, identifying drugs they had prescribed by brand name with estimates of cost savings that might have been realized by prescribing generic drugs, while the control group received no feedback. Followup monitoring of both groups continued for 12 months after all feedback had ceased. Median weighted rates of generic

prescribing for the experimental physicians were 14 percent for the baseline, 67 percent for the feedback, and 54 percent for the followup periods, whereas rates for the control physicians were 32 percent, 37 percent, and 31 percent, respectively. The increase in generic prescribing by physicians in the experimental group was significantly greater than for control physicians. The authors concluded that the feedback model improved rates of generic prescribing and should be evaluated for broader areas of physician prescribing.

- 135 Gortmaker, S.L., A.F. Bickford, H.O. Mathewson, and others. (1988, June). A Successful Experiment to Reduce Unnecessary Laboratory Use in a Community Hospital. *Medical Care* 26(6), pp. 631–642.**

A series of interventions at a 228-bed hospital provided physicians with regular feedback concerning the amount of laboratory services employed in treating patients. Casemix-adjusted estimates of laboratory tests allowed physicians to compare use of tests with peers in the same department. Physicians with “excess” practice patterns ordered hundreds more laboratory tests than average each year. A multifaceted education program included the following elements: (1) meetings were held concerning costs and unnecessary laboratory tests; (2) physicians were given descriptions of practice patterns relative to their peers as part of departmental discussions; (3) the feedback was repeated a year later; (4) a consensus conference established guidelines for test ordering; and (5) a sample of patient records was examined for appropriateness of laboratory test ordering. The results included (1) 37 percent of a sample of tests classified inappropriate that had been ordered during the baseline period (32 months) by physicians with “excess” practice patterns; (2) a reduction of 1.8 tests per patient; (3) reductions in use in eight of the nine tests; (4) a statistically significant reduction in laboratory charges per patient from the target hospital in the quarter following program initiation and no evidence for change in the

five comparison hospitals; and (5) no evidence for reductions in the ordering of essential tests. The results demonstrate that a cost-effective approach to reducing unnecessary costs can be implemented in hospitals with integrated data systems.

- 136 Hershey, C.O., H.I. Goldberg, and D.I. Cohen. (1988, January). The Effect of Computerized Feedback Coupled With a Newsletter Upon Outpatient Prescribing Charges: A Randomized Controlled Trial. *Medical Care* 26(1), pp. 88–93.**

A randomized controlled trial was conducted to test the effect of computer feedback alone versus computer feedback in combination with a newsletter upon resident physician prescribing habits. The objective was to reduce total prescribing charges for medical outpatients and to improve resident knowledge of charges and therapeutics. A total of 50 residents in the Department of Medicine at Cleveland Metropolitan General Hospital were randomly assigned to 4 independent units called firms and subsequently received monthly computer printouts summarizing their prescriptions. After 2 months, two firms (experimental group) began receiving a monthly newsletter in addition to the printout, addressing different therapeutic topics and designed to deal with one of the drug classes on the monthly feedback forms. Prior to distributing the first newsletter, a pretest was completed by all 50 residents, followed 9 months later by a posttest to measure change in knowledge of the drugs and their charges. While both groups had positive attitudes towards the feedback, data collected from 49 (98 percent) respondents to the questionnaire did not differ significantly with respect to pharmacy charges or knowledge of charges among the experimental and control groups; however, the numbers were sufficient to detect a 15 percent reduction in both the mean charge per prescription and the number of prescriptions. The authors conclude that future work must be directed toward developing more effective means for transmitting information about the efficacy and costs of pharmaceuticals.

- 137 Keller, R.B., D.N. Soule, J.E. Wennberg, and others. (1990, October). Dealing With Geographic Variations in the Use of Hospitals: The Experience of the Maine Medical Assessment Foundation Orthopaedic Study Group. *Journal of Bone and Joint Surgery, Incorporated* 72-A(9), pp. 1286–1293.

Orthopaedists and other physicians in Maine organized the Maine Medical Assessment Foundation to deal with the problem of variations in the rates of hospitalization for selected orthopaedic conditions. Five musculoskeletal injuries and five orthopaedic procedures were selected for study, using discharge abstracts of inpatients in Maine hospitals from 1984 to 1986. Findings indicate that the variation in decisionmaking by orthopaedists was least for fractures of the ankle and fractures of the hip and was greatest for fractures of the forearm, derangement of the knee, and lumbosacral sprain. The rates in a geographic area tended to be consistently high or low for the same treatments, with the major reasons for the variations related to the lack of agreement about optimum treatment. Feedback of data to physicians on variations in patterns of practice reduced the variations; however, the authors conclude that physician knowledge regarding clinical outcomes of each procedure must be improved.

- 138 Myers, S.A. and N. Gleicher. (1988, December). A Successful Program to Lower Cesarean-Section Rates. *New England Journal of Medicine* 319(23), pp. 1555–1516.

A prospective initiative was developed to reduce the rising number of cesarean-section deliveries from 25 percent to 11 percent of all deliveries at an inner-city hospital in Chicago. The program was based on conclusions reached by a 1980 task force of the National Institutes of Health. Included in the program were voluntary participation by the physicians, a stringent requirement for a second opinion, objective criteria for the four most common indications for cesarean section, and a detailed review of all cesarean sections and physicians' rates of performing them. Through feedback, all attending physicians were informed of their personal cesarean-section rates at quarterly intervals. The rates of both primary and repeat

cesarean sections decreased from 17.5 percent of 1,697 deliveries in 1985 to 11.5 percent of 2,301 deliveries in 1987, although only the decline in primary cesarean sections, from 12 to 6.8 percent, was statistically significant. During the same period, operative vaginal deliveries (forceps deliveries and midpelvic procedures) declined from 10.4 to 4.3 percent of total deliveries. The authors conclude that a voluntary initiative within an obstetrics department can reduce cesarean-section rates substantially without adverse effects on the outcome for mother or infant, although larger study populations and longer study periods are required before the principles of this initiative can be accepted.

- 139 Restuccia, J.D. (1982, January). The Effect of Concurrent Feedback in Reducing Inappropriate Hospital Utilization. *Medical Care* 20(1), pp. 46–62.

This study, conducted in four general hospitals, evaluates the effectiveness of feedback utilization review coordinators in reducing the number of inappropriate hospital days (a total of 1,456 Medicare medical and surgical service patients were reviewed). Experimental control was exerted over the type of feedback provided in the utilization review process to produce four treatment groups (including a control group) that vary according to (1) the channel used to inform an attending physician of a probable inappropriately located patient; and (2) the amount of discretion permitted the nurse coordinator in deciding whether, when and to whom this information is provided. The results indicate that physician and hospital performance in utilization review, measured by inappropriate patient days and length of stay, are affected by the feedback strategy. For patients inappropriately located for a portion of their hospital stay, provision of concurrent feedback resulted in a reduction of approximately two-thirds of an inappropriate day and two and one-half total days, compared with patients for whom no feedback was provided or for whom physician advisor involvement was required. The authors discuss various factors associated with making the feedback system operate in the hospital, noting the key roles played by direct communication, the degree of discretion

allowed in the feedback decision, and the importance of having nurse coordinators provide the feedback to physicians in a "non-sanctioned" manner.

- 140 Rosser, W.W. (1983, September). Using the Perception-Reality Gap to Alter Prescribing Patterns. *Journal of Medical Education* 58, pp. 728-732.

In this study, 30 physicians in a university family medicine teaching practice were asked to estimate their rate of prescribing diazepam to 6 age/sex groupings of patients within their practice—approximately 12,000 registered patients. The actual prescribing rates as recorded by a computerized data collection system were not accurately perceived by the prescribing physicians. After the physicians were informed of the gap between perceived and actual prescribing, significant changes in prescribing behavior occurred. Through feedback, awareness of a perception-reality gap in primary care practice prescribing offers a method of continuing medical education that may significantly alter prescribing behavior in ways beneficial to patient care. Key to the process is weakening physicians' resistance to change by demonstrating deviations in practice from what is "reasonable and responsible."

- 141 Siscovick, D.S., D.S. Strogatz, E.H. Wagner, and others. (1987, March). Provider-Oriented Interventions and Management of Hypertension. *Medical Care* 25(3), pp. 254-258.

The authors evaluated a set of provider-oriented interventions designed to enhance the clinical management of patients with high blood pressure and sought to influence physician behavior by providing physicians with information on the process of care in an audit of the practice's medical records. The setting of the study was a multispecialty group practice; the population was 531 patients seen between October 1981 and June 1982, with a diagnosis of hypertension, having been followed in the practice for at least 2 years. The sample consisted of 460 patients with 71 excluded because they appeared to be normotensive. Findings from the study suggest

that the provider-oriented interventions may have reduced the proportion of hypertensive patients who dropped out of the practice but did not influence blood pressure control among those remained. The 30 percent reduction in practice dropouts demonstrated in the study's analysis complements the findings of others and suggests that systematic efforts to follow up hypertensive patients who miss appointments may be an effective approach to maintaining patients under care in the community practice of medicine. The authors' findings are similar to other studies that found that computer-based reminder systems improved followup with patients with newly diagnosed hypertension.

- 142 Spiegel, J.S., M.F. Shapiro, B. Berman, and S. Greenfield. (1989, March). Changing Physician Test Ordering in a University Hospital: An Intervention of Physician Participation, Explicit Criteria, and Feedback. *Archives of Internal Medicine* 149, pp. 549-553.

To decrease inappropriate test ordering by medical house staff in a university hospital, the authors examined the feasibility of an intervention that involved physicians in developing explicit criteria for ordering four specific tests and incorporated feedback of tests ordered. The study was a time series design with measures at 12 and 6 months before, during, and 3 weeks after the intervention, with tests ordered over the different time periods for a total of 1,791 patients and 11,437 patient days. During the intervention, orders for initial or admission chest roentgenograms decreased by 22 percent and repeated orders for routine urinalyses, chest roentgenograms, and leukocyte differential counts decreased by 23 percent, 30 percent, and 46 percent, respectively, compared with the 6-month preintervention period. Orders for prothrombin time and/or partial thromboplastin time did not fall. The most significant test-ordering changes were observed for repeat tests. After the intervention, most test ordering remained at the intervention level. Physician involvement in developing the test ordering criteria could be replicated in other hospitals without significant resource demands.

- 143 Tierney, W.M., M.E. Miller, and C.J. McDonald. (1990, May). The Effect on Test Ordering of Informing Physicians of the Charges for Outpatient Diagnostic Tests. *New England Journal of Medicine* 322(21), pp. 1449-1504.

The authors examined the effect of informing physicians of charges for outpatient diagnostic tests in an academic primary care medical practice. This randomized controlled trial consisted of 121 physicians who participated by ordering all diagnostic tests at microcomputer workstations. For half (the intervention group), the charge for the ordered test and the total test charge for that patient on that day were displayed on the computer screen while the control group also used computers, but with no message about charges. In the 14 weeks before the study, the number of tests and the average charge for tests per patient visit were similar for both groups; during the 26-week intervention, physicians in the intervention group ordered 14.3 percent fewer tests per patient visit than the control group and the charges were 12.9 percent lower. During the 19 weeks after the intervention, the number of tests ordered by the physicians in the intervention group was only 7.7 percent lower than the number ordered by the control group, and the charges were only 3.5 percent lower. The authors conclude that displaying the charges for diagnostic tests significantly reduced the number and cost of tests ordered especially for patients with scheduled visits, although the effects of this intervention did not persist. Hospital information systems may provide a cost-effective means of informing physicians of the financial consequences of their actions.

- 144 Wennberg, J.E., L. Blowers, R. Parker, and A.M. Gittelsohn. (1977, June). Changes in Tonsillectomy Rates Associated With Feedback and Review. *Pediatrics* 59(6), pp. 821-826.

This report (1) describes trends in incidence of tonsillectomy, with or without adenoidectomy, and of adenoidectomy alone in the years 1969 through 1973 in Vermont and the United States, and the variations and trends among individual Vermont hospital service areas; (2) suggests that reporting data

on incidence to practicing physicians can stimulate and facilitate changes in medical practices; and (3) proposes that this hypothesis be tested in other areas within the context of Professional Standard Review Organizations. Among 13 Vermont hospital service areas, tonsillectomy rates decreased over a 5-year period. In 1969, the rates in seven areas exceeded the estimated United States national rate; by 1973, the average rate for all areas had declined 46 percent and only one area remained above the U.S. rate. Much of the change occurred after feedback of data to the Vermont State Medical Society demonstrating variations for 1969. In 12 of the 13 areas, the relationship between feedback and change in clinical practices could not be documented; however, physicians in the area with the highest rate reviewed the indications for tonsillectomy and adopted a second opinion procedure for reviewing surgery candidates. The experience suggests that feedback of population-based data on incidence of procedures may be a valuable tool for the peer review process.

- 145 Winickoff, R.N., K.L. Coltin, M.M. Morgan, and others. (1984, June). Improving Physician Performance Through Peer Comparison Feedback. *Medical Care* 22(6), pp. 527-534.

The authors evaluated a project to improve physician performance in colorectal cancer screening as part of an ambulatory quality assurance program using a minimum standard for digital examination and stool test for occult blood at annual check-ups of patients age 40 years and older. During a 3.5-year period, three different intervention strategies for improved compliance with the standard were sequentially implemented and assessed: educational meeting, retrospective feedback of group compliance, and retrospective feedback of individual compliance compared with that of peers. A pretest/posttest design was employed in evaluating the first two intervention strategies. Neither strategy significantly improved compliance, and monthly feedback of individual performance ranked with that of peers was then implemented in a randomized clinical trial utilizing a crossover design. Results show that (1) during the first 6-month period, the

physicians receiving feedback (group 1) improved from 66 percent to 79.9 percent, and the control group also improved, from 67.5 percent to 76.6 percent; (2) during the second 6-month period, group 2 received feedback and group 1 did not; (3) group 1 stabilized at approximately 80 percent while group 2 continued to improve from 76.6 percent to 84 percent; and (4) behavior changes persisted at 6 and 12 months after intervention. The authors conclude that criteria for quality and cost-effectiveness will inevitably change with new knowledge and changing economic climate, and peer comparison feedback is one method of change that may apply to a variety of situations.

Other Methods

- 146 Avorn, J., and S.B. Soumerai. (1983, June). Improving Drug-Therapy Through Educational Outreach: A Randomized Controlled Trial of Academically Based "Detailing." *New England Journal of Medicine* 308(24), pp. 1457-1463

This paper reports on a 3-year investigation designed to develop noncoercive ways of improving the accuracy and appropriateness of physicians' prescribing of drugs. An office-based physician education program was implemented to reduce the excessive use of three drug groups: cerebral and peripheral vasodilators, an oral cephalosporin, and propoxyphene. A 4-State sample of 435 physicians (who wrote 20 or more prescriptions per year from each of 2 drug groups or 30 or more prescriptions per year from any group) was identified through Medicaid records and randomly assigned to one of three groups. The study indicates that face-to-face education (academically based "detailing") of the practicing physician is an effective means of reducing less than optimal prescribing decisions; this can generate important changes in the nature and cost of drug use. Physicians who were offered personal educational visits by clinical pharmacists along with a series of mailed "unadvertisements" (materials prepared in

accordance with communications theory and behavioral change research) reduced their prescribing of the target drugs by 14 percent compared with controls, while no such change was observed in physicians who received mailed materials only. The effect persisted for at least 9 months after the start of intervention, and no significant increase in the use of expensive substitute drugs was found.

- 147 Avorn, J., M. Chen, and R. Hartley. (1982, July). Scientific versus Commercial Sources of Influence on the Prescribing Behavior of Physicians. *American Journal of Medicine* 73, pp. 4-8.

Physicians often deny the relative importance of commercial sources in influencing their prescribing—either because they are unaware of it or because they are reluctant to admit to being influenced by nonscientific sources. A random sample of 85 primary care physicians in the Boston area was interviewed to determine the relative contributions of scientific and commercial sources of information about two drug groups (cerebral vasodilators and propoxyphene analgesics) on their prescribing practices and their beliefs concerning what influenced their choice of the drugs. The majority of practitioners perceived themselves as paying little attention to drug ads (68 percent), detail men (54 percent), and patient preference (74 percent), while academic sources were rated by physicians as major determinants of their behavior. Furthermore, it was found that physicians certified by the American Board of Internal Medicine (36 percent of the sample) seemed less influenced by commercial messages for one of the drug groups than their colleagues. However, the results show the predominance of nonscientific rather than scientific sources of drug information being used in physicians' drug choice, which is consistent with what would be predicted from communications theory and marketing research data. The data indicate the need for innovative means of communicating unbiased drug information to practicing physicians.

- 148 Chambers, C.V., D.J. Balaban, B.L. Carlson, and others. (1989). Microcomputer-Generated Reminders: Improving the Compliance of Primary Care Physicians With Mammography Screening Guidelines. *Journal of Family Practice* 29(3), pp. 273–280.

The authors investigated the influence of a microcomputerized “tickler system” or reminder bulletin (which links clinical encounter and billing data) on the ordering of mammograms. A total of 1,262 women age 40 years and older, who made visits to an outpatient office during a 6-month period, were randomly assigned to 1 of 2 groups. For the experimental group, the date of the last mammogram ordered and recorded in the clinical data base was printed on the encounter form generated for each patient visit, while no information regarding previous mammograms was printed for patients in the control group. The results showed that women in the experimental group were more likely to have a mammogram ordered during the study period (19 percent versus 12 percent), and, as a result, were more likely to be in compliance with mammography guidelines at the study’s completion (27 percent versus 21 percent). This study showed that a microcomputerized reminder system can be used to increase physicians’ compliance with preventive health screening recommendations. The authors discuss the results in light of the potential limitations of the study: (1) the inherent potential for a computer record to contain incomplete or inaccurate data and (2) the choice of mammography screening, which has been traditionally very low.

- 149 Cohen, D.I., B. Littenberg, C. Wetzel, and D.vB. Neuhauser. (1982, October). Improving Physician Compliance with Preventive Medicine Guidelines. *Medical Care* 20(10), pp. 1040–1045.

Similar general medical outpatient clinics with randomly assigned patients at Cleveland Metropolitan General Hospital were used to evaluate a program to increase house staff compliance with preventive medicine guidelines; two clinics were designated experimental and two as controls. In experimental clinics, age-specific checklists of

all recommended preventive procedures (from the Canadian Task Force report on The Periodic Health Examination and American Cancer Society guidelines) were appended to each patient’s chart. House officers were presented with weekly seminars in screening issues and the specific recommendations in the checklists. House officers in all four clinics were tested for their knowledge and attitudes toward the preventive program before and after the intervention; counts of immunizations and mammograms and the total populations eligible for these procedures were determined for all four clinics. As predicted, test scores and mammography and immunization rates increased significantly from 2 to 40 percent in intervention clinics compared with controls. Checklists were more important than seminars in changing behavior, and changed attitudes were more closely associated with increased numbers of preventive procedures than increased knowledge. The authors conclude that this intervention was effective in the short run; however, followup studies will be necessary to determine whether the desired long-term effect was achieved.

- 150 Frame, P.S., B.A. Kowulich, and A.M. Llewellyn. (1984). Improving Physician Compliance With a Health Maintenance Protocol. *Journal of Family Practice* 19(3), pp. 341–344.

A 2-year prospective study was conducted to determine whether the use of specific educational, organizational, and behavior reinforcing interventions could improve physician compliance with a protocol of selected health maintenance procedures in the private practice setting. The procedures studied included history of tobacco use, blood pressure determination, history of alcohol use, fecal occult blood testing for colon cancer, Pap smears, and physician breast examinations. In addition, two chart-recording items were audited—use of the screening flow sheet and use of the problem list. Overall compliance with these procedures improved from 58 percent to 72 percent (4 of 5 physicians’ performance improved) although there were marked differences in compliance among the procedures—ranging from 51 percent of patients’ having a fecal occult

blood screening for colon cancer to 99 percent having their blood pressure recorded. The compliance with the use of a screening flow sheet was much less (29 percent of patients' charts) than compliance with specific procedures (43 percent). The findings suggest that compliance with health maintenance procedures can be improved with motivated physicians who believe in the value of the screening procedures—the specific interventions used may be less important than the fact that some intervention has occurred.

- 151 Martin, A.R., M.A. Wolf, L.A. Thibodeau, and others. (1980, December). A Trial of Two Strategies to Modify the Test-Ordering Behavior of Medical Residents. *New England Journal of Medicine* 303(23), pp. 1330–1336.

Two methods to reduce the ordering of laboratory and radiologic tests by medical residents were studied. Randomly dividing the 24 first-year residents into three groups, the effect of concurrent chart review and discussion in one group was compared with the effect of a moderate financial incentive in a second group. The third group served as a concurrent control, and data (a random sample of 104 charts) on the testing patterns of residents at the same hospital the year before the study provided a retrospective control. After a base-line period of observation, all residents, including those in the control group, had statistically significant reductions in laboratory testing during the intervention period of the study; chart review produced the most dramatic and sustained reductions (47 percent) compared with 29 percent in the incentive group. Moreover, the chart review group was the only group with significant reductions in the number of different tests ordered and repeated tests. The financial incentive seemed to be of no value when the testing pattern of this group was compared with that of the control group, and no significant effect on radiologic testing was achieved in any of the groups. Concurrent chart review appeared considerably more

effective than either a financial incentive or didactic presentation.

- 152 McDonald, C.J., S.L. Hui, D.M. Smith, and others. (1984, January). Reminders to Physicians from an Introspective Computer Medical Record: A Two Year Randomized Trial. *Annals of General Internal Medicine* 100(1), pp. 130–138.

The authors developed a computer-stored medical record system containing a limited set of the total clinical data base—primarily diagnostic studies and treatments; the system responds to its own content according to physician-authored reminder rules. To determine the effect on physician behavior of the reminder messages generated by 1,490 rules, practitioners were randomly assigned in a general medical clinic to study or control groups. The computer found indications for 6 different actions per patient involving 12,467 patients during a 2-year study: (61 study group residents who received computer reminders responded to 49 percent of these indications; 54 control group residents responded to only 29 percent). Preventive care (occult blood testing, mammographic screening, weight reduction diets, influenza and pneumococcal vaccines) was affected. The intentions of the study group to use a given action for an indication predicted their response to the indications while the intentions of the control residents did not. The computer reminder messages had a strong and persistent effect on patient care. The authors conclude that although computer reminder messages are potent activators of physicians' intentions, they have little influence on the acceptance of new practices.

- 153 Sadowsky, D. and C. Kunzel. (1991, July). The Use of Direct Mail to Increase Clinician Knowledge: An Intervention Study. *American Journal of Public Health* 81(7), pp. 923–925.

A probability sample of 1,148 American general practice dentists, 40 years of age or

older, in solo practice was the target of 2 direct mail interventions (686 actual respondents, a 87.2 percent response rate) offered at 2 different times, to test whether knowledge regarding prophylaxis of patients at risk for infective endocarditis could be improved. Tests of knowledge were responses in a mail questionnaire to clinical vignettes designed to elicit the content of antibiotic regimens used for patients at risk. The research design enabled detection of (1) the effect of the interventions, (2) the differences in their effect, (3) the attenuation of their effect, and (4) the effect of time. Where baseline knowledge was low, it was improved and did not rapidly disappear; both mail interventions were equally effective in most instances, and there was no attenuation of the interventions' effect and effect of time on the control group's knowledge over a 4.5-month period.

- 154 Schaffner, W., W.A. Ray, C.F. Federspiel, and W.O. Miller. (1983, October). Improving Antibiotic Prescribing in Office Practice: A Controlled Trial of Three Educational Methods. *Journal of the American Medical Association* 250(13), pp. 1728-1732.

The authors conducted a statewide (Tennessee) controlled trial of three educational methods to improve antibiotic prescribing in office practice: a mailed brochure, a drug educator visit, and a physician visit. Educational topics were limited to three antibiotics contraindicated for office practice and oral cephalosporins; Medicaid prescribing data were used to select physicians for the education. The effect of each educational method was evaluated by comparing the change in prescribing (1 year before the intervention and 1 year after). The results show that (1) the mailed brochure had no detectable effect; (2) the drug educator had only a modest effect; (3) the physician visits produced strong attributable reductions in prescribing of both drug classes; (4) for the

contraindicated antibiotics, the reductions were 18 percent in number of physicians prescribing, 44 percent in number of patients per physician receiving these drugs, and 54 percent in number of prescriptions written per physician; and (5) for the oral cephalosporins, both number of patients and number of prescriptions per physician were reduced by 21 percent. The physicians responded equally well to recommendations designed to improve the quality of care and to reduce the cost of care. The authors conclude that physicians are more likely to heed the advice of physician colleagues who bear an educational message.

- 155 Schroeder, S.A., L.P. Myers, S.J. McPhee, and others. (1984, July). The Failure of Physician Education as a Cost Containment Strategy: Report of a Prospective Controlled Trial at a University Hospital. *Journal of the American Medical Association* 252(2), pp. 225-230.

To test the hypothesis that physician education is an effective strategy to reduce total hospital costs, the authors evaluated three educational interventions at a large university hospital. This prospective controlled study spanned 2 academic years involving 1,663 patients and 226 house staff. In the first year, weekly lectures on cost containment (medicine and surgery) and audit with feedback (medicine only), failed to produce a significant change in total hospital charges. The intervention was increased on medicine in the second year by combining the lecture and audit strategies, and again, total charges did not change significantly. While decreased use occurred for certain selected services, the impact was not great enough to affect total hospital charges significantly. The authors conclude that, in the absence of other cost containing incentives, physician education alone is not an effective hospital cost containment strategy. The authors suggest that support of powerful authority figures is a necessary precondition for educational maneuvers to reduce the use of laboratory procedures.

- 156 Soumerai, S.B. and J. Avorn. (1984). Efficacy and Cost-Containment in Hospital Pharmacotherapy: State of the Art and Future Directions. *Milbank Memorial Fund Quarterly/Health and Society* 62(3), pp. 447-474.

Few studies have investigated approaches to improve the ways physicians make drug-use decisions. This review describes several approaches to improving in-hospital drug use decisions, assessing the evidence for their effectiveness in changing practice to point the way toward more useful interventions, and identifying areas in need of research. All published studies of noncommercial programs to improve physician-prescribing for hospitalized patients were initially screened for review; only studies that attempted to document changes in prescribing behavior were included. A number of specific conclusions are drawn from the best-designed studies: (1) the provision of printed drug bulletins or articles, alone, has been relatively ineffective in changing prescribing behavior; (2) single notices providing aggregated results of drug therapy audits have not been demonstrated to be effective in the inpatient setting, although no well-controlled trial of this strategy has been conducted; (3) both group education thorough lectures or rounds and group discussions of audits have produced mixed effects that are ambiguous, given the lack of adequately controlled studies; and (4) one-to-one education initiated by a clinical pharmacist has been shown in two partially controlled studies to reduce the overall number or cost of drugs prescribed to inpatients. In contrast to prevalent opinion, the overall conclusion from this review is that education can upgrade physicians' clinical decisionmaking in the hospital without restraining their therapeutic prerogatives.

- 157 Soumerai, S.B. and J. Avorn. (1990, January). Principles of Educational Outreach ('Academic Detailing') to Improve Clinical Decision Making. *Journal of the American Medical Association* 263(4), pp. 549-556.

Physicians' choices of drugs frequently fall short of the ideal of precise and cost-effective decisionmaking. Evidence indicates that such decisions can be improved in a variety of ways. A number of theories and principles of communication and behavior change underlie the success of pharmaceutical manufacturers in influencing prescribing practices. Based on this behavioral science and several field trials, it is possible to define the theory and practice of methods to improve physicians' clinical decisionmaking to enhance the quality and cost-effectiveness of care. Some of the most important techniques of such "academic detailing" include (1) conducting interviews to investigate baseline knowledge and motivations for current prescribing patterns; (2) focusing programs on specific categories of physicians as well as on their opinion leaders; (3) defining clear educational and behavioral objectives; (4) establishing credibility through a respected organizational identity, referencing authoritative and unbiased sources of information, and presenting both sides of controversial issues; (5) stimulating active physician participation in educational interactions; (6) using concise graphic educational materials; (7) highlighting and repeating the essential messages; and (8) providing positive reinforcement of improved practices in followup visits. The authors note the consistency of these principles with adult education theory. Use of these techniques by the nonprofit sector has been shown to reduce inappropriate prescribing as well as unnecessary health care expenditures.

Computerized Data Bases, Expert Systems, and Medical Informatics

- 158 Anderson, J.G. and S.J. Jay. (1985). **Computers and Clinical Judgment: The Role of Physician Networks.** *Social Science and Medicine* 20(10), pp. 969-979.

In order to study the relationship between physician networks and utilization of a computer-based hospital information system (HIS), blockmodel analysis and multidimensional scaling were used to analyze and spatially represent the network of professional relations among 24 physicians in a private group practice. The analysis of patient referrals, consultations, discussions, and on-call coverage identified four groups of physicians who share common locations and perform similar roles within the network. The results suggest that the center-periphery model of diffusion of new ideas among professionals may be too simplistic, and instead, the communication network may involve multiple central cohesive subgroups of physicians who differentially initiate patient referrals and consultations with physicians in other subgroups. Network location was found to have a significant effect on the adoption and utilization of the HIS independent of background and practice characteristics. The results also suggest that adoption of an innovation and its implementation or utilization may involve separate processes that need to be differentiated in future research. The study demonstrates how social network analysis can be used to identify and characterize the social structures that underlie professional relations and to study the relationship between these structures and the adoption and use of medical innovations.

- 159 Anderson, J.G., S.J. Jay, H.M. Schweer, and M.M. Anderson. (1986). **Physician Utilization of Computers in Medical Practice: Policy Implications Based on a Structural Model.** *Social Science and Medicine* 23(3), pp. 259-267.

The development of policies for use of computer-based medical technology is hampered by a lack of knowledge about the

process by which such applications are adopted and utilized by physicians. This study tested a model of the process by which physicians change their practice behavior using a computer-based hospital information system (HIS). A structural model was developed and tested using data from 270 members of the medical staff of a 1,160 bed, private teaching hospital. The model specified the relationship among the variables that characterize the process by which physicians change their practice behavior. Use of the model suggested that there is a substantial relationship between the physician's location in the consultation network and increased use of a computer-based HIS. The study demonstrates the importance of peers in communicating the availability of new computer applications in medicine and in validating their clinical use. The authors suggest that use of new computer medical applications could be accelerated by targeting physicians in a way to facilitate interphysician communication and by using a variety of different teaching formats to enhance awareness.

- 160 Barnett, G.O., J.J. Cimino, J.A. Hopp, and E.P. Hoffer. (1987). **DXplain An Evolving Diagnostic Decision-Support System.** *Journal of the American Medical Association* 258(1), pp. 67-74.

DXplain is an evolving computer-based diagnostic decision-support system designed for use by physicians with no computer expertise. DXplain accepts a list of clinical manifestations and then proposes diagnostic hypotheses. The program explains and justifies its interpretations and provides access to a knowledge base concerning the differential diagnosis of the signs and symptoms. DXplain was developed with the support and cooperation of the American Medical Association (AMA), and it is distributed to the medical community through AMA/NET—a nationwide computer communications network sponsored by the AMA—and through the Massachusetts

General Hospital Continuing Education Network. A key element in the distribution of DXplain is planned collaboration with physician-users whose comments, criticisms, and suggestions will play an important role in modifying and enhancing the knowledge base.

- 161 Dalrymple, P.W. (1990, July). CD-ROM Medline Use and Users: Information Transfer in the Clinical Setting. *Bulletin Medical Library Association* 78(3), pp. 224-232.

Effective delivery of biomedical information to health professionals depends on the availability of systems that are compatible with the information-seeking patterns of health professionals. MEDLINE is a major source of biomedical information, but it has been available primarily through libraries via telecommunications networks. The recent availability of MEDLINE on CD-ROM has made it possible to provide MEDLINE directly to clinicians without the associated problems of telecommunications and online use charges. This article reports on health professionals' uses of six compact disk versions of MEDLINE in seven clinical settings with the observations drawn from clinical evaluations conducted in conjunction with the National Library of Medicine (NLM); the factors were reported at the MEDLINE on CD-ROM Evaluation Forum held September 23, 1988. Key issues in the design and development of information technologies in the clinical setting are also articulated.

- 162 Haynes, R.B., K.A. McKibbin, C.J. Walker, and others. (1990, January). Online Access to MEDLINE in Clinical Settings: A Study of Use and Usefulness. *Annals of Internal Medicine* 112(1), pp. 78-84.

The authors introduced self-service access to a medical literature data base, MEDLINE, and the full-text service of BRS Colleague, into clinical settings of McMaster University Medical Center to assess the frequency, patterns, purposes, and success of use. Overall, 158 trainees and attending staff participated in a 2-hour introduction to online searching and 2 hours of free search time.

Interviews were conducted after a random sample of searches. To assess competency, search questions were given to 1 of 3 librarians and 1 of 13 clinicians with previous experience in online searching. The results revealed that (1) 81 percent of participants performed an average of 2.7 searches per month; clinicians retrieved 55 percent of the number of relevant articles retrieved by reference librarians and 50 percent more irrelevant articles; and (2) of 5,307 citations retrieved in 280 searches, 821 (15 percent) were rated as directly relevant to the search question, 2,180 (41 percent) were rated interesting but not relevant, and 2,306 (43 percent) were rated irrelevant. The authors conclude that MEDLINE searching from clinical settings is feasible with training and affects clinical decisions; inexperienced searchers miss many relevant citations and search inefficiently.

- 163 Haynes, R.B., M. Ramsden, K.A. McKibbin, and others. (1989). A Review of Medical Education and Medical Informatics. *Academic Medicine* 64, pp. 207-212.

Physicians have considerable difficulty collecting and interpreting information from patients, dealing with the uncertainties associated with diagnosing and treating their patients, communicating precisely with one another, keeping up to date, and applying recommended procedures when indicated. The authors believe that some of the advances in information technology may help physicians manage information more effectively through more accessible, validated clinical indexes, data bases of diagnostic test characteristics, computerized audits of clinical activities with feedback, expert systems, online access to the medical literature, and other tools of medical informatics. Medical educators can catalyze this process by facilitating the introduction of information technology into academic clinical settings so that students can learn its use firsthand, thus promoting the use and possible application of medical information to problems in health care. They suggest that medical informatics be incorporated into medical school curricula and recommend a variety of other actions to maximize the

potential of medical informatics to help address problems of information management in health care.

- 164 Hersh, W.R. and R.A Greenes. (1990). *Information Retrieval in Medicine: State of the Art. M.D. Computing* 7(5), pp. 302–311.

The field of information retrieval is concerned with representation, storage, and retrieval of heterogeneous textual information.

Conventional information retrieval systems usually involve searching by terms from controlled, keyword-based vocabularies—as with the medical subject headings (MeSH) vocabulary of the National Library of Medicine’s MEDLINE data base—or by individual words in the text (full-text retrieval). These systems have been commercially successful but are limited by several problems, including cumbersome interfaces and inconsistency with human indexing. The limitations of keyword systems, particularly the expense and inconsistency of human indexing, have led to research on information retrieval systems that perform automatic indexing including vector-based, probabilistic, and linguistic. This article describes these systems (with accompanying references) and provides an overview of the field of information retrieval in medicine. The authors conclude that improved access to information through improvements to information retrieval systems, computer hardware, and mass storage technologies (CD-ROM, laser disks), should lead to better medical care.

- 165 Holman, J.G. and M.J. Cookson. (1987, July/August). Expert Systems for Medical Applications. *Journal of Medical Engineering and Technology* 11(4), pp. 151–159.

The authors present a tutorial introduction to expert systems in medicine, explaining the basis of the technology, its current limitations, and its prospective uses. Expert systems, also known as intelligent knowledge-based systems (IKBS), are computer programs that act as decision-support systems. They possess three basic components: (1) a user interface—the system component with which the user has immediate contact and which determines

acceptability and ease of use; (2) the knowledge base, which contains the expertise required to solve problems in the domain, with the knowledge expressed in a suitable formal language and appropriate data structures devised for storage retrieval and manipulation; and (3) an interpreter or “inference engine,” which puts the expertise contained in the knowledge base to work in solving the problem presented by the user. Expert systems are currently being applied to a number of medical domains, notably diagnosis and treatment planning. Their function is to assist the practitioner by providing access to the levels of skill possessed by experts. Much research effort has been expended, but few systems have reached routine medical use mainly because much medical practice is not computerized and because of the problem of data entry.

- 166 Hubbard, S.M., J.E. Henney, and V.T. DeVita. (1987). A Computer Data Base for Information on Cancer Treatment. *New England Journal of Medicine* 316(6), pp. 315–318.

The Physician Data Query (PDQ) system is a clinically oriented computer data base developed to make recent information on cancer treatment widely available to the medical community. It represents an effort by the National Cancer Institute to promote diffusion of information about the treatment of cancer throughout the country, facilitate access to clinical trials, and accelerate the practical application of advances in research. The computer system provides information about state-of-the-art cancer treatment, which is updated monthly by an editorial board. It also includes a file of active cancer-research protocols and a directory of physicians and organizations providing cancer care to which physicians can gain access by geographic location as well as other features. PDQ was designed for physicians who may not be familiar with computers to permit them to search for and display without learning a specialized search language. PDQ uses a computer mainframe, which allows a large amount of data to be stored and made available to physicians rapidly and accurately. Transmission of information over commercial telecommunication networks using a computer

terminal and local telephone lines expands use of PDQ.

- 167 Kaplan, B. (1988, Summer). Development and Acceptance of Medical Information Systems: An Historical Overview. *Journal of Health and Human Resources Administration* 4, pp. 8–29.

Medical Information Systems (MISs), developed in the late 1960's, and hospital information systems use computers for storing, retrieving, and transmitting information for clinical, administrative, business, and research purposes. The author presents an overview of the historical development of MISs with a more detailed discussion of three seminal MISs including (1) Technicon, designed for direct use by physicians and nurses; (2) the Computer-Stored Ambulatory Record (COSTAR), designed to fit individual physician practices and traditional medical practice and used by physicians, nurses, administrators, and data entry clerks; and (3) the Problem-Oriented Medical Information System (PROMIS), designed to provide corrective feedback to physicians on the health care provided in any medical practice and meant to be an alternative to the traditional medical record. Despite a number of obstacles to the use of computers in medicine including lack of funding and staffing, poor management, insufficient medical knowledge, and physician resistance, there have been many successes in medical computing. The change process cannot be forced and new computer systems cannot simply be mandated. The author concludes that when the change process is well managed, when the computer system does not radically challenge fundamental values and practice, and when it provides benefits that potential users easily identify as important and meaningful, the chances of success are greatly improved.

- 168 Lincoln, T.L. (1990). Medical Informatics: The Substantive Discipline Behind Health Care Computer Systems. *International Journal of Biomedical Computing* 26, pp. 73–92.

The computer is rapidly becoming an interactive workstation for medical research

and for clinical decisionmaking, and it has become a preferred instrument for communication and documentation throughout health care. However, in using rigid conventions of information processing to impose order on the volatile and unpredictable phenomena in the clinical setting, deep-seated logical issues are uncovered. This challenge has generated the new field of medical informatics, a goal of which is to formulate computer logics that can properly relate the idealized descriptions of disease, the rules for medical practice, and the general guidelines for health care to the intricate diversities encountered in the care of individual patients. The author presents an overview of what constitutes medical informatics as a problem-oriented information science that investigates all forms of computer processing in health care. The author examines the field and its concern with (1) expert systems and (2) intelligent data bases and online reference data bases (such as a MEDLARS type format, DIALOG) and presents requirements and implementation issues of clinical information systems. The Integrated Academic Information System (IAIMS) program of the National Library of Medicine provides the most ambitious environment for research in this new endeavor.

- 169 Paisley, W. (1991). New Media and Methods of Communication. Paper presented at Conference on Effective Dissemination of Clinical and Health Information, Tucson, Arizona, September 22–24, 1991. Forthcoming.

The author reviews the spectrum of new media and methods of health communication, focusing on the many information systems that bring data, information and knowledge to health care practitioners and consumers. A review of such systems is presented, including the following: synchronous (telephone) and asynchronous voice communication (answering machines and voice mail); synchronous (online searching, telefacsimile, and videotext) and asynchronous (E-Mail and computerized bulletin boards) digital communications; portable media (audio/video tapes, video disks, optical and floppy disks, and CD-ROMs); and within fixed media, local mainframes and personal computers.

These types of communication systems are described, and the pros and cons of dissemination via computer/telecommunications technology are discussed. The critical role that information use plays in designing a dissemination system and in dissemination research is presented, with comment that information use is grounded in time, in psychological factors, in specialty differences, in social network, and in sociodemographic factors. The author notes that in the future, full-text data bases will be very important, and changes in computer/telecommunication systems will be characterized by expansion, differentiation, and reintegration.

- 170 Perry, C.A. (1990, July). Knowledge Bases in Medicine: A Review. *Bulletin of the Medical Library Association* 78(3), pp. 271-282.

Efforts to represent knowledge effectively, from simple "electronic textbooks" to sophisticated knowledge-based systems, have been central to progress in medical informatics. The limited domains and structured language of medicine, as well as the importance of information in providing good medical care, have made research in medical knowledge representation intense. The author reviews representative knowledge bases and knowledge-based systems in medicine: electronic textbooks such as Physicians Data Query (PDQ) and the Hepatitis Knowledge Base (HKB), rule-based systems such as MYCIN, causal models (for example, CASNET), and hypothesis- or frame-based systems, exemplified by PIP and INTERNIST-1. The review describes the relationships among divergent approaches, discusses current and future trends, and examines problems in knowledge representation and acquisition. These include the use of domain-independent software shells for constructing knowledge bases, the adaptation and use of previously existing knowledge bases, and multiple uses of the same knowledge base for different purposes. Several major themes result from this examination: (1) the tendency of knowledge-base developers to learn from one another and to incorporate more than one approach to knowledge representation in devising

knowledge bases and (2) by taking less ambitious courses, knowledge bases may be more practical than research value.

- 171 Smith, Jr., J.W., J. Svirebely, and E. Fannin. (1988, December). A Gentle Introduction to Knowledge-Based Systems in Medicine. *Topics in Health Record Management* 9(2), pp. 36-54.

The authors examine how the concepts and techniques of artificial intelligence (AI), (defined as the study of complex information processing problems often having roots in some aspect of biological information processing), are being applied to medical problem solving. This study illustrates central ideas in a subfield of AI, knowledge-based systems, which attempt to create human-machine systems that can solve specific classes of problems in a particular area of specialization by encoding the problem-solving expertise that humans use. By example of diagnosis, some types of medical knowledge and physician reasoning approaches such systems must encode are shown. Specifically, approaches to encoding are presented using MYCIN (a production rule system) and Present Illness Program (PIP), which demonstrate more clearly the complexity of the problem domains under consideration, how that complexity can be dealt with, and the limitations and potential of AI. These systems are generating a re-examination of what is considered "intelligent" behavior, which may itself lead to future concepts, systems, and tools. Moreover, the fundamental goal of generality in the design of AI systems makes such things as, for example, the hypothetico-deductive model of behavior transferrable across domains, with potential for revitalization and re-examination in each.

- 172 Waxman, H.S. and W.E. Worley. (1990). Computer-Assisted Adult Medical Diagnosis: Subject Review and Evaluation of a New Microcomputer-Based System. *Medicine* 69(3), pp. 125-136.

The capacity of the computer to store data and carry out swift computations represents an important aid that may help the physician in the demanding task of medical diagnosis. In

this article, the authors review the development and current status of computer-assisted medical diagnosis, discuss the problems associated with this field, and evaluate several software programs currently in use (MEDITEL pediatric system, Internist-1 (adult medicine), RECONSIDER, MEDICOMP, INTERNIST and successors, NASA DSS, Quick Medical Reference, and DXplain). The experience with MEDITEL (Computer-Assisted Diagnosis, Adult System, owned in part by the authors) and other systems illustrates current issues these systems pose. Such issues include physician acceptance and the ethical, legal, and regulatory aspects of computer applications and their aid in diagnosis and in evaluation of computer-based medical "expert" systems in general. Although the physician remains central and indispensable to the diagnostic process, the authors conclude that in appropriately selected cases, the accuracy and efficiency of physician diagnosis can be enhanced with computer assistance, and the risk of overlooking the correct diagnosis can be reduced.

- 173 Weaver, R.R. (1991). Assessment and Diffusion of Computerized Decision Support Systems. *International Journal of Technology Assessment in Health Care* 7(1), pp. 42-50.

Innovations that proved beneficial or detrimental to patient care can be readily identified in retrospect while it is more difficult, of course, to do the same prospectively. Although the rational deployment and use of medical technologies presupposes an adequate assessment of costs and benefits to the patient before adoption, medical technology assessments are often inadequate. This article identifies and discusses the weaknesses of approaches to assessing computerized decision support (CDS) systems, examining the design of two CDS systems, DXplain and the Problem Knowledge Coupler (PKC). The two cases

illustrate that CDS systems vary considerably in their design and implementation. DXplain was developed to provide physicians what they want and might use, acting as an "electronic textbook," with minimal changes in "social relations." PKC was developed to transform firmly rooted ways of thinking about and solving patients' problems, which implies substantial change in medical practice. In either case, the use of conservative or innovative CDS systems will produce only slight or gradual social change; the rational deployment of these and other CDS technologies awaits adequate assessment.

- 174 Weed, L.L. (1986). Knowledge Coupling, Medical Education and Patient Care. *Critical Reviews in Medical Informatics* 1(1), pp. 55-79.

A critical examination of the difference between the "educated expert" and the "uneducated" as well as the difference (less focused on) between what the "educated expert" knows and does and what the problem ideally requires, reveals to us how misplaced our confidence is in the present premises of education. These premises have led us to trust the unaided human mind in the face of many variables at the time of problem solving. In the field of medicine, there is abundant evidence from many sources that there is a serious "voltage drop" from knowledge of what should be done in a clinical situation to what is actually done for the average patient on the average clinical encounter. The author describes his own computer-based knowledge coupler, which "couples" unique patient problems to the current knowledge base and exemplifies how the system might work in the case of vertigo. The author reviews the weaknesses of curricula and curricular reform in medical care and examines the need for introducing new premises and new tools for problem solving, changing the system of care, and developing a system of education (performance-based curriculum).

Background Articles and Miscellaneous References

- 175 Brook, R.H. (1989, December). Practice Guidelines and Practicing Medicine: Are They Compatible? *Journal of the American Medical Association* 262 (21), pp. 3027–3030.

The author discusses various factors (including increased financial pressures on the health system, the rapidity of the introduction of technology, and data showing high levels of inappropriate care) that will yield practice guidelines when combined into a movement. If the guidelines are developed with the aid of the best methods and if they are applied constructively, then the twin goals of increased health of the American public and physician satisfaction can be achieved. Within these goals, specific benefits of disseminating the information on practice guidelines are suggested by the author.

- 176 Dixon, A.S. (1990, March). The Evolution of Clinical Policies. *Medical Care* 28(3), pp. 201–220.

Physicians use clinical policies as guidelines in the day-to-day management of patients. Some policies, by reducing otherwise complicated dilemmas to simple rules, encourage improved patient outcomes, but some are adopted without any evidence of benefit; some may be extended beyond their proper limitations and others are used despite accumulating data that they are at best useless and at worst dangerous. A variety of questions surround the way in which clinical policies evolve, especially those policies that deploy innovative ideas in medical care. The literature suggests that there are four crucial stages in the evolution of clinical policies: (1) development, (2) diffusion, (3) domination, and (4) disillusionment. A brief review of the literature on diffusion is presented, along with a discussion of why simple diffusion of clinical practice guidelines does not appear to have led to changes in physician behavior. Social rather than scientific forces play a central role, and at each step characteristic

errors in both reasoning and research may occur. Attempts to improve patient outcomes by encouraging more appropriate research methodology and increasing the ability of physicians to critically appraise published studies may not be successful unless account is also taken of the social forces that influence the use and abuse of clinical policies.

- 177 Eddy, D.M. (1990, January). Clinical Decision Making: From Theory to Practice. *Journal of the American Medical Association* 263 (3), pp. 441–443.

This article discusses the importance of decisionmaking in health practice and the role of the practicing physician in choosing the action that is most likely to deliver outcomes that patients find desirable. A decision consists of two steps—an estimate of the outcome of alternative practices and a comparison of the desirability of the outcome of each option. Decisions are based on three principles: (1) health outcomes, (2) effects of a practice on outcomes (estimated as accurately as possible given available evidence), and (3) preferences assigned to the outcomes of an intervention; they should reflect as accurately as possible the preferences of patients. If physicians are provided good information regarding how alternative practices affect outcomes important to patients, then physicians can discuss that information with patients and help them evaluate the options. However, it is not realistic to expect that physicians can estimate the outcomes of different decisions accurately since this requires access to research results, analytic skills, and time—none of which are readily available to many practicing physicians. The author's solution is to analyze as many decisions as possible in advance, taking whatever time, resources, and skills needed to make the most accurate estimates of the outcomes of alternative practices and then disseminate this information to practicing physicians.

- 178 Ford, L.G., C. Hunter, P. Diehr, and others. (1987, March). Effects of Patient Management Guidelines on Physician Practice Patterns: The Community Hospital Oncology Program Experience. *Journal of Clinical Oncology* 5(3) pp. 504–511.

The Community Hospital Oncology Program (CHOP), funded by the National Cancer Institute from 1981 to 1984, was designed as a model for delivery of cancer care in the community. Site-specific management guidelines were developed by physicians who saw a majority of cancer patients and represent a consensus of current information on pretreatment evaluation and management. A patterns of care study was conducted in 17 CHOPs to determine the influence of guidelines on practice patterns. The practice elements examined are clinical staging for breast and small-cell lung cancer, medical oncology consultation for breast cancer patients with positive lymph nodes, and radiation therapy consultation for rectal and small-cell lung cancer. Although all guidelines discussed the importance of staging before definitive treatment for breast cancer, only 33 percent of the 1,922 charts examined had a stage recorded, and in small-cell lung cancer, 67 percent of 388 charts examined had a stage recorded. Years in practice of the primary physician had an inverse relationship to practice patterns defined by the guidelines, and physician specialty was a determinant of practice patterns for small-cell lung cancer. However, participation in guideline development and dissemination did not significantly enhance the adoption of care elements, and except for physicians most active in the CHOP, the data provide no evidence of diffusion of guideline principles to the majority of physicians.

- 179 Fowkes, F.G.R. and C.J. Roberts. (1984). Introducing Guidelines into Clinical Practice. *Effective Health Care* 1(6), pp. 313–321.

A worldwide trend towards insurance-based systems of health care has accelerated the impetus for practice guidelines. Guidelines or recommendations, preferably developed by clinicians, describe how and when individual clinical activities should be offered to achieve

safe clinical practice at a socially acceptable cost. The authors review the results of a study by the Royal College of Radiologists in the United Kingdom on the use of pre-operative chest X-rays. A review of 10,619 consecutive cases of elective non-cardiopulmonary surgery undertaken in 8 centers revealed that use of chest X-rays varied from 11.5 percent to 54.2 percent, and that the chest X-ray did not seem to influence decisions to operate or to use inhalation anaesthesia. The study failed to find “any evidence at all for the effectiveness of pre-operative chest X-ray when used routinely,” and it was estimated that even if the procedure was 10 percent effective, the costs of avoiding one death would be approximately 1 million pounds sterling. These findings stimulated the College to develop guidelines for using pre-operative X-rays in hospitals in a three-stage process: introducing the idea of a change in practice; introduction of guidelines into clinical practice; and sustained implementation. Each stage is described, including three methods of implementation—feedback, concurrent review of practice, and recording protocols.

- 180 Goldberg, H.I. and H. McGough. (1991). Testing the Implementation of Clinical Guidelines. *IRB: A Review of Human Subjects Research* 13(6), pp. 1–7.

This report focuses on the potential application of “firm” systems, an innovative research methodology, to the problem of evaluating the effects of the clinical guidelines that will be produced in response to the goals and activities of the Agency for Health Care Policy and Research. The paper examines the ethical issues associated with implementation of clinical practice guidelines that attempt to stimulate voluntary changes in physician behavior. The authors present a description of three broad categories of “firm” trials that might be used to test the implementation of clinical guidelines based on the following interventions: (1) educational, (2) administrative, and (3) clinical. These categories of trials approximate a hierarchy of increasing risks, warranting increasing intensive review and consent procedures in order to protect the welfare of the people involved. The underlying assumptions and the ethical and regulatory issues are discussed for

each kind of trial. The authors contend that the principles involved in the firm-system research could be applied to more traditional comparisons of strategies aimed at improving care by changing physician behavior.

- 181 Gottlieb, L.K., C.Z. Margolis, and S.C. Schoenbaum. (1990, February). Clinical Practice Guidelines at an HMO: Development and Implementation in a Quality Improvement Model. *Quality Review Bulletin—Journal of Quality Assurance* 16(2), pp. 80–86.

This article describes the evolution, structure, methods, and future agenda of the Algorithm Based Clinical Quality Improvement Process (ABCQIP) at the Harvard Community Health Plan (HCHP). A clinical algorithm sets forth a stepwise procedure for making decisions about the diagnosis and treatment of clinical problems. When implemented effectively, it may both improve quality and decrease costs by guiding clinicians toward more standardized, clinically optimal, cost-effective strategies and by facilitating more valid measurement of clinical process and outcomes. Since algorithms are clear and concise and can be represented graphically, they provide an excellent basis for communicating and representing specifications of optimal clinical care. Algorithms provide a method for scrutinizing clinical information that allows for easy isolation of clinical decisions to be reviewed. Potential approaches to implementing algorithms include disseminating them through continuing medical education programs, clinical reminder systems, administrative changes, and computerized systems that contain the algorithm and supporting documentation. As an illustration of the algorithm development process, the authors review a case study on the evaluation and management of abnormal pap smears.

- 182 Haynes, R.B. (1990, November). Loose Connections Between Peer-Reviewed Clinical Journals and Clinical Practice. *Annals of Internal Medicine* 113(9), pp. 724–728.

Physicians often have difficulty in maintaining current awareness of important medical

advances reported in the biomedical literature. This article examines the ways in which peer-reviewed clinical journals contribute to this problem and proposes solutions for both editors and clinical readers. Peer-reviewed clinical journals impede the dissemination of validated advances to practitioners by mixing a few rigorous studies (communications from scientists to practitioners) with many preliminary investigations (communications from scientists to scientists). The most important dissemination problem is that most peer-reviewed clinical journals attempt to serve more than one audience. Journals wishing to improve communication with practitioners should feature rigorous studies of the nature, cause, prognosis, diagnosis, prevention, and treatment of disease; sound clinical review articles (communications from practitioners to practitioners); and syntheses of the journal literature. Additional strategies for improving communication between medical scientists and practitioners include (1) improving publication standards for clinical journals, (2) providing more informative abstracts for clinical articles, (3) improving the scientific standards for review articles, (4) fostering the development of derivative literature services, and (5) enhancing practitioners' skills in critically appraising the medical literature.

- 183 Jennett, B. (1988). Assessment of Clinical Technologies: Importance for Provision and Use. *International Journal of Technology Assessment in Health Care* 4, pp. 435–445.

Diffusion and use of modern medical technologies has had a profound impact on the hospital environment, the doctor-patient relationship, and the humanity of the patient. Evidence supporting the need for more information concerning the value of various technologies comes from approximately 130 papers published in the last decade on geographical variations in the provision and use of various technologies—variations that occur both between countries and within them. Technology assessment is only one of several influences that determine policy and practice in the provision and use of diagnostic and therapeutic technologies in the hospital. The author discusses the importance of developing standards by which to judge the

human and economic impact of particular technologies in the diffusion and use of modern medical technologies. It is noted that there has been insufficient attention to changing clinical practice by systematically using technology assessment. The author calls for studies on what influences clinical practice and how change can be brought about. Widely disseminating technology assessment findings is a critical first step; additional research could decrease the inappropriate use of medical technology and would provide guidelines to improve current use.

- 184 Leape, L.L. (1990, February). **Practice Guidelines and Standards: An Overview.** *Quality Review Bulletin—Journal of Quality Assurance* 16(2), pp. 42–49.

The recent surge of interest in the idea of practice guidelines and standards in health care results from the convergence of growing financial concerns (due to rising health care costs and insurance premiums); evidence of unnecessary care from the inadequate production, evaluation, and dissemination, and use of information; and emergence of a promising technology for developing meaningful guidelines and standards. This article presents an overview of the characteristics of useful guidelines and standards, how they should be used and developed, who should develop them, and how they should be disseminated. The new practice guidelines are formally developed, highly specific guidelines based on the clinical research literature and the collective judgments of expert physicians; guidelines represent a new technology for technology assessment. The beginning of a national commitment to the development of guidelines and standards was observed with the establishment by Congress in 1989 of the Agency for Health Care Policy and Research (AHCPR) and its Forum for Quality and Effectiveness in Health Care. The author contends that an urgent priority for AHCPR's Forum for Quality and Effectiveness in Health Care is to develop standards for the standard development process.

- 185 Lomas, J. (1988). **Holding Back the Tide of Caesareans: Publishing Recommendations is not Enough to Stop the Rise.** *British Medical Journal* 297, pp. 569–570.

The remarkable consistency in an upward trend for the past 20 years in cesarean sections has generated widespread concern and attempts to stop the rise. The targeted attempts to reduce the rate of cesarean births have nearly all focused solely on the poor knowledge of research findings. From these findings, recommendations on using cesarean section, usually calling for reduced rates, have been published; however, the long list of other causes of rising rates of cesarean section suggests that published recommendations are a necessary but insufficient condition to change doctors' behavior. Therefore, more aggressive measures are being taken to implement recommendations. For example, the consensus statement implementation project (CSIP), a research study in randomly selected and assigned community hospitals, disseminates interventions supporting the recommendations. The author concludes that without clearly targeted initiatives, the multifaceted causes driving the rate of cesarean section upwards will influence doctors' behavior far more than continued calls from researchers for a reduced rate.

- 186 Lomas, J., G.M. Anderson, and others. (1989, November). **Do Practice Guidelines Guide Practice? The Effect of a Consensus Statement on the Practice of Physicians.** *New England Journal of Medicine* 321(19), pp. 1306–1311.

This study evaluates the effect of distributing medical practice guidelines generated by a national medical specialty association. Guidelines for medical practice can contribute to improved care only if they succeed in moving actual practice closer to the behaviors the guidelines recommend. To assess the effect of such guidelines, hospitals and obstetricians in Ontario were surveyed before and after the release of a nationally distributed and endorsed consensus statement

recommending decreases in the use of cesarean sections—a mailing was sent to all obstetricians on the mailing list of the society and all hospitals with more than 50 beds. These surveys, along with discharge data from hospitals, revealed that most obstetricians (87–94 percent) were aware of the guidelines and that most (82.5–85 percent) agreed with them; attitudes toward the use of cesarean section were congruent with the recommendations before their release. One-third of the hospitals and obstetricians reported changing their practice and obstetricians reported rates of cesarean section in women with a previous cesarean section that were significantly reduced as a consequence of the recommendations (from 72.2 percent to 61.1 percent); however, knowledge of the content of the recommendations was poor. The authors conclude that (1) guidelines for practice may predispose physicians to change behavior; however, unless there are incentives or removal of disincentives, guidelines are unlikely to change practice; and (2) incentives should operate locally, although they may include system-wide economic changes.

- 187 McCormick, B. (1990, October). Can Research Change the Way MDs Practice Medicine? *Hospitals* 64(19), pp. 32–37.**

This article reviews outcomes research studies and related forms of health services research including their effect in the clinical setting and how the findings are disseminated to clinicians and others in the health care community. Implementation of several approaches are described, including (1) using corporation-wide outcomes data for quality management in hospitals in the Louisville-based Humana, Inc., system; (2) “clinical forums” in selected hospitals, where physicians review the effectiveness of practice, in Intermountain Health Care, Inc., Salt Lake City; (3) a statewide effort to examine practice variation in Maine hospitals; (4) the development of practice guidelines in Vermont hospitals; and (5) the funding of studies to enhance the effectiveness of care at the Strong Memorial Hospital in Rochester, New York. Findings suggest that dissemination efforts should target hospital physicians who play pivotal roles in applying

research findings to patient care, with the goal of improving the health care system. Several problems identified by the research include the lack of comparable data from those facilities conducting health services research, the need for collecting and sharing comparable data among academic medical centers and institutions, and the need for local adaptations of national practice guidelines. Clinical practice guidelines are, with outcomes and effectiveness research, one of the most important applications of clinical data.

- 188 McPhee, S.J., R.J. Richard, and S.N. Solkowitz. (1986, Sept./Oct.). Performance of Cancer Screening in a University General Internal Medicine Practice: Comparison with the 1980 American Cancer Society Guidelines. *Journal of General Internal Medicine* 1(5), pp. 275–281.**

This study of general internal medicine practice was conducted at the University of California, San Francisco, to evaluate use of 7 cancer screening tests by 52 providers, using the 1980 American Cancer Society (ACS) guidelines. Performance rates were determined by retrospective medical record reviews of a stratified random sample of 525 patients and from interviews of 48 physicians and 4 nurse-practitioners in the office to determine their opinions, knowledge, and perceived use of tests. The study results show that (1) performance rates were significantly below the ACS guidelines for all tests except Pap Smear; (2) providers used the tests significantly more often to evaluate patients with cancer risk factors or for new patients; (3) the physicians and nurse-practitioners significantly overestimated their own performances of six tests; and (4) more than a fourth of the providers disagreed with the use of mammography, sigmoidoscopy, and pelvic or rectal examinations for screening asymptomatic adults. The study found the knowledge of providers about cancer screening and the ACS recommendations to be limited and variable. Providers offered four major reasons for not performing the screening tests: (1) provider forgetfulness, (2) lack of time, (3) inconvenience and logistical difficulties, and (4) patient discomfort or refusal.

- 189 Sadowsky, D. and C. Kunzel. (1989). Professional Life Cycle Changes and Their Effect on Knowledge Level of Dental Practitioners. *Social Science Medicine* 29(6), pp. 753–760.

This article examines the effect of age-related professional characteristics on dentists' knowledge of preventing infective endocarditis. Utilizing national data, two questions were addressed: (1) do age-related characteristics produce different effects on knowledge level at various stages of a professional career?; and (2) what are the key changes in these age-related characteristics, and what processes are suggested by these changes? Multiple regression analysis assessed the influence of potential predictors of variation in knowledge. Using these findings, variation in the effect of predictor variables was analyzed for early professional life—less than age 40; midprofessional life—ages 40–54; and older professional life—age 55 or greater. Results show that (1) age had a profoundly negative effect on knowledge level; (2) the impact of age-related characteristics on knowledge varied according to the stage of professional life cycle; (3) indices measuring the size or extent of theoretical understanding, in-office networks, institutional affiliations, and consulting networks were significant predictors of knowledge for younger clinicians; and (4) for those 40–54 years old, only practice organization was a significant predictor, while for older clinicians theoretical understanding was the only significant predictor. The authors conclude that efforts to increase knowledge on infective endocarditis prevention should focus on increased levels of activities on age-specific variables, with emphasis on increasing the level of theoretical understanding for the oldest and most deficient group.

- 190 Salem-Schatz, S.R., J. Avorn, S.B. Soumerai. (1990, July). Influence of Clinical Knowledge, Organizational Context, and Practice Style on Transfusion Decision Making: Implications for Practice Change Strategies. *Journal of the American Medical Association* 264(4), pp. 471–475.

Evidence shows that blood products, like other health care resources, are often used inappropriately, but the reasons for this have not been well studied. The authors conducted a face-to-face survey of 122 general surgeons, orthopedic surgeons, and anesthesiologists in three hospitals to evaluate the influence of several clinical and nonclinical factors on transfusion decisionmaking. Widespread deficiencies in physicians' knowledge of transfusion risks and indications were found. Fewer than half of the physicians surveyed estimated each transfusion risk correctly, and only 31 percent responded correctly to a set of four questions regarding transfusion indications. Attending physicians routinely had lower knowledge scores than did residents, yet they exhibited more confidence in their knowledge. Residents' transfusions decisions were strongly influenced by the desires of their attending physicians, resulting in their ordering potentially inappropriate transfusions. Furthermore, of the residents surveyed, 61 percent indicated that they ordered transfusions that they judged unnecessary at least once a month because a more senior physician suggested that they do so. These findings provide insights for the development of strategies to improve transfusion practices to address the issues of quality of care and cost containment. The authors suggest that opinion leaders and other mechanisms are needed to disseminate new information aimed at modifying physician behavior.

- 191 Steinbrook, R. and B. Lo. (1990, April). Informing Physicians About Promising New Treatments for Severe Illnesses. *Journal of the American Medical Association* 263(15), pp. 2078–2082.

Physicians are increasingly informed of promising new treatments for severe illnesses through unconventional communications such as press releases, press conferences, and direct mailings. These announcements disseminate information quickly many months before new data are presented at medical meetings or published in peer-reviewed journals. However, such unconventional communications usually do not provide sufficient detail for physicians to evaluate studies, answer patients' questions, or make recommendations. The authors discuss traditional and unconventional means of informing physicians about therapeutic advances for life-threatening and severe illnesses. The focus is on the initial communication of results, not on secondary dissemination, such as continuing medical education, cable television and radio programs for physicians, or informal discussions with colleagues. They suggest that physicians would be better informed about advances through (1) expanded information in unconventional communications; (2) increased availability of information from the Food and Drug Administration (FDA); (3) early submission and accelerated review of key medical journal articles; and (4) expanded use of online computerized information sources. Rapid dissemination of information about promising new therapies is crucial for patients with illnesses that have no effective treatment, and the scientific value of unconventional communications should be improved to help save or prolong the lives of such patients.

- 192 White, L.J. and J.R. Ball. (1990, February). Integrating Practice Guidelines With Financial Incentives. *Quality Review Bulletin—Journal of Quality Assurance* 16(2), pp. 50–53.

Pressures to reduce health care costs today are unrelenting, and they have led to acrimonious debates among all involved parties. Guidelines for medical practice are being recommended as a means to solve some of these problems. The American College of Physicians (ACP) has been in the forefront of medical professional societies in recognizing the need for sound policies to help guide appropriate clinical practice and in calling for a restructured payment system that is clinically effective. Practice guidelines, in whatever form, hold significant implications for the delivery and the financing of health care, hence great care must be taken in developing them. Guidelines must be scientifically sound and defensible, they must incorporate clinical perspectives and consider patients' preferences, they must cover appropriate as well as inappropriate services, and must foster creation and adoption of a rational payment system. Guidelines can enable physicians, faced with an overwhelming array of often conflicting information, to reduce some of the uncertainty they must cope with and to practice the most clinically effective medicine, since for them to do so requires valid information from a credible source, most often in conjunction with appropriate financial incentives.

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